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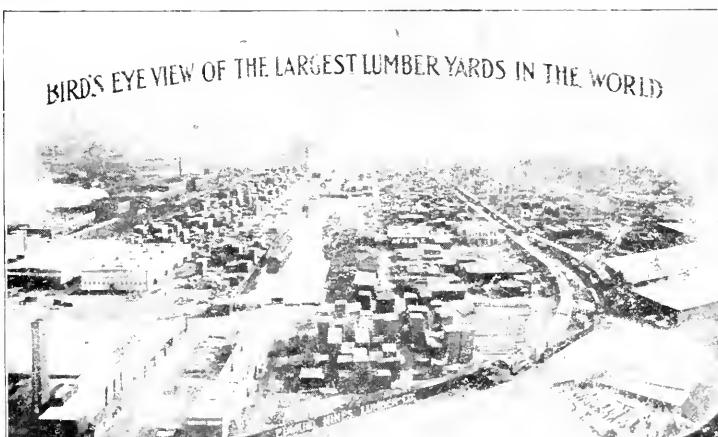
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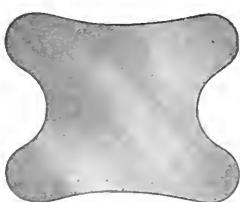
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1909

TWELFTH YEAR

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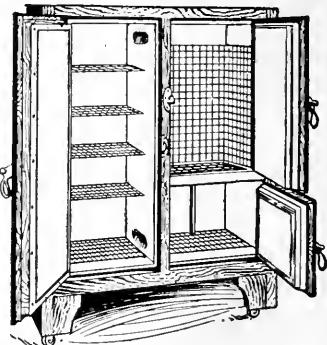
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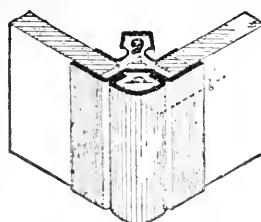
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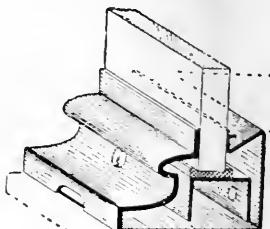
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Preface

ONLY objects of real value are counterfeited. There is nothing so productive of jealousy as success. If the eleven issues of this Handbook had not been of real intrinsic value, then this book would not have been the subject of vicious attacks on the part of others attempting to occupy the same field, as has been the case during the past year; nor would there have sprung up several new publications attempting to take the place of this work.

We wish all others the same success which we have attained but we wish to make our work more successful with each succeeding issue. We realize that unless there is a step forward there is sure to be a loss of ground. This year's book offers many new tables of useful data.

We also publish for the first time the new Schedule of Charges and Code of Practice of the Chicago Architects' Business Association and a new article by Professor N. Clifford Ricker on base plates for columns, and we add to our contributors this year, Mr. Benjamin E. Winslow, a consulting civil engineer, who will edit matters pertaining to structural design.

Mr. Homer R. Linn, a consulting mechanical engineer, still continues to edit all matter pertaining to heating and ventilation.

We offer this year a relative index as a supplement to the Dewey Index and giving reference to all articles published in previous handbooks, which are not reprinted in this issue.

Friendly, sincere criticism is always appreciated. We are glad and shall always be glad to have the frank suggestions of the users of the book as to any improvements which may be embodied in future issues.

The book is published for the Chicago Architects' Business Association because of the demand of its members for an absolutely authoritative reference work on the subject matter contained. To this end, no limit of expense of either time or money is considered.

A reference work which meets the demand of architects and is used by them continuously, becomes a valuable advertising medium for those building contractors and material manufacturers and dealers who furnish material and labor for building purposes. Having caused the publication of this work, the Association became possessed of a commercially valuable commodity. This has been placed on the market for sale at its commercial value, and revenues thus obtained are used, first, to pay the expenses of publication, and second, to increase the Association's general expense fund.

Contracts with advertisers are based solely on the commercial display value of advertisements and on no other consideration whatsoever. No promises are made or can be made on the part of the Association or any of its members or representatives that they will specify or use any of the materials advertised. Advertisers whose goods or service do not possess intrinsic merit are advised to avoid contracting for advertising space in this publication. Others will find it a valuable means of publicity.

A special commission has been engaged for some time on preparing a revision of the Building Ordinances. It was hoped that this revision would be ready for publication at our time of going to press, but we are now authoritatively informed that the passage of this Ordinance will probably be delayed until about January 1, 1910; so we go to press with the present Ordinances with all the amendments thereto to date, as same will be the rules under which building operations will continue until the new Ordinances go into effect. However, as soon as the new Ordinances are passed, we have made arrangements to have same printed and bound into this book. These supplements will be sent to all users of the Handbook, by special messengers, so far as they can be reached, and all those who cannot be reached in person will receive same by mail.

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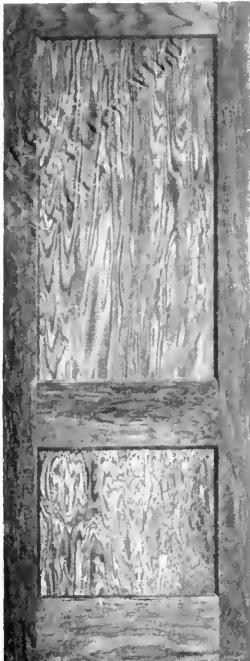
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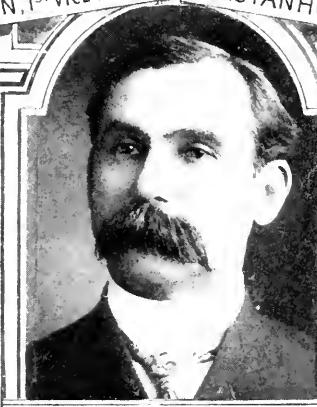
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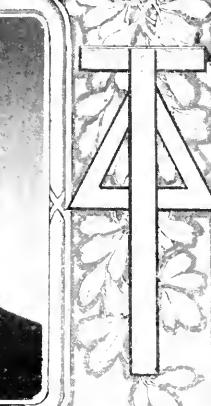
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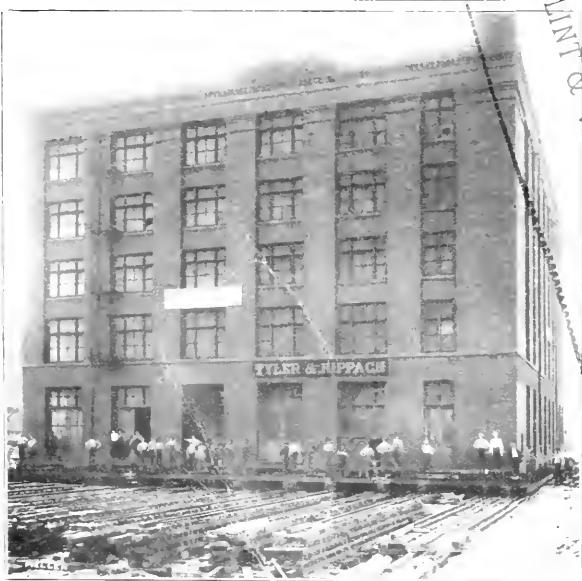
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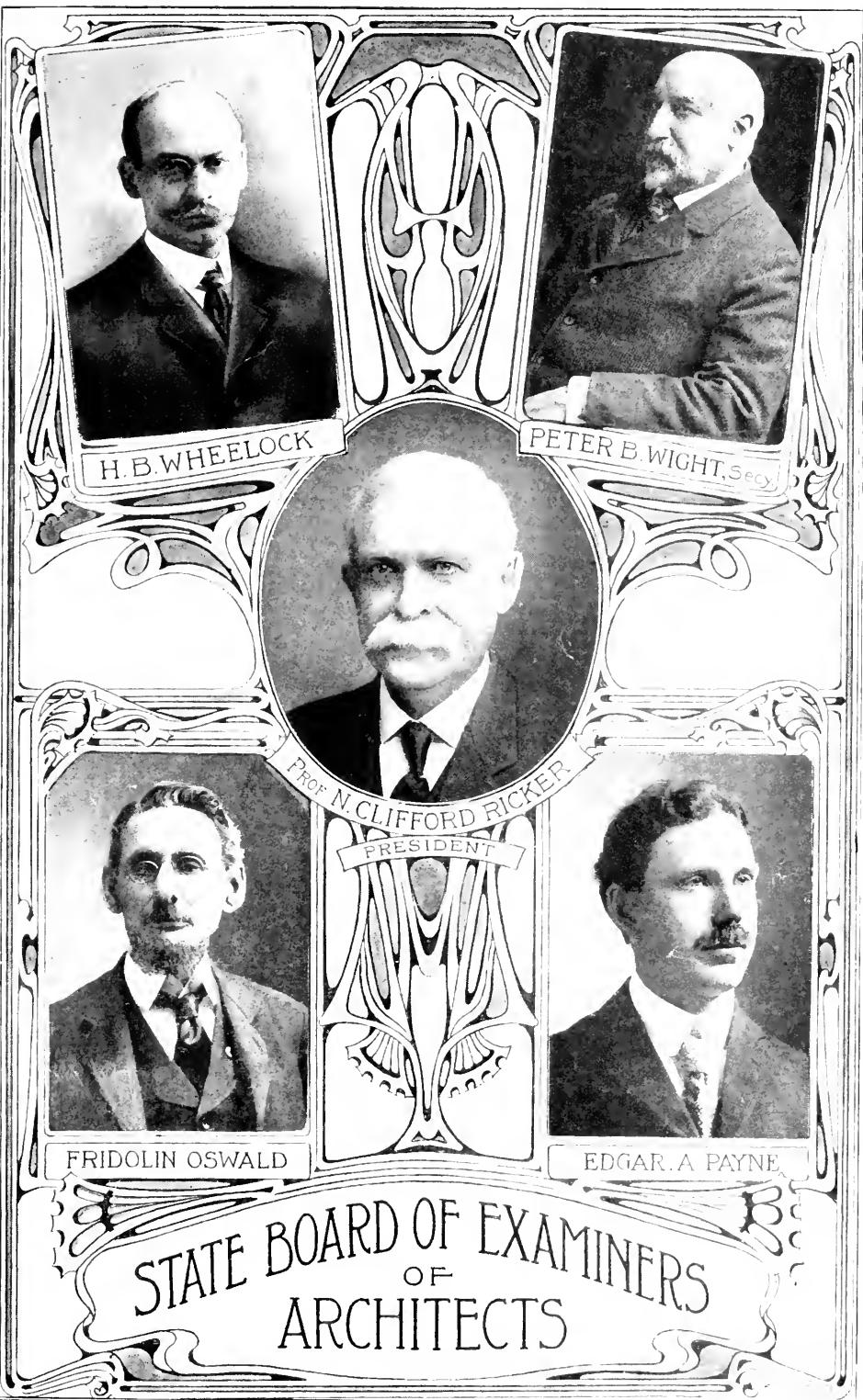
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Chicago Architects' Business Association

Organized January 12, 1897. Incorporated June 25, 1897

The year 1908-09 has been epoch making in the matter of the establishment of high professional standards. The American Institute of Architects has had important committees engaged in the exhaustive study and preparation of written Canons and a Code of Ethics, to make clear the proper principles which should govern the professional conduct of architects. The Chicago Architects' Business Association, ever on the alert in matters of this kind, has adopted a Code based on the work of this committee of the Institute, but modified to meet the characteristic views which dominate the Association.

As the Association is a local institution only attempting to express views of the architects of the State of Illinois, and as the State of Illinois has taken a position far in advance of that of most other States, in the protection of the public as to the character of architectural service, it becomes especially important that the architects of that State should consider public duty of greatest importance. In consequence, our Association has considered it proper to place the architect's duty to the public ahead of his duty to himself or his client; thus reversing the order of the Articles of Canons and of Ethics, as prepared by the Institute committee.

Doubtless all intelligent and honorable practitioners now follow and always have followed, in spirit and intent, the principles laid down in the Sections of the Code, as elucidated in the Canons of Ethics. But because some members of the profession from one reason or another seem to disregard the observance and actual practice of high ethical principles, it therefore becomes the duty of professional organizations to set forth in the proper written form those principles of professional conduct which should obtain, and the reasons why.

This duty of professional organizations

is made clearly important when it is understood that the average individual does not build even once in a life-time and that those who do build, rarely build more than once. No written standard has been published and architects form such a very small percentage of the population (in this state not more than fifteen one hundredths of one per cent), that comparatively few people ever meet an architect except when they require his services, and so generally are not informed as to what to expect. In consequence it is not strange that the public is not versed as to what conduct they have a right to expect from the architects whom they employ; nor can they be blamed for asking their architect to do untenable things.

Considerable success has been attained by the committee having in charge the securing of the adoption of uniform sizes for printed matter to be distributed to architects' offices. We are glad to announce that the Pennsylvania State Association of the American Institute of Architects has recently adopted the Association's standard sizes.

The work of our committee on Public Action has been fraught with considerable difficulty in the matter of uniform enforcement of Chicago laws, because it is not always possible to work in perfect harmony with public officials.

During the year the work of enforcing the state laws governing architects has been most successfully carried on. The State Board for Licensing and Examining Architects deserves the heartiest commendation for its sincere and earnest effort to eliminate dishonest practitioners from the practice of architecture in the state. The board finds it extremely difficult to get necessary evidence in cases of violation of law. Principles of public good should actuate all persons submitting charges of violation of law. Unfortunately, charges are sometimes submitted by those actuated by motives of personal

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jealousy. Of course, such cases must fall flat. The Association does not encourage the filing of petty charges against any one; but if persistent rumors are to be at all credited, there are still a considerable number of men who are in open and daily violation of the License Law. This condition evidences great need of conscientious, public-spirited investigation, of apparent illegal practices. Architects throughout the state who are possessed of any tangible information should send it at once to the secretary of the committee on Public Action of our Association. The matter can then be thoroughly investigated, and, if the committee thinks sufficiently important, they will place same before the State Board, who will proceed to put their machinery in force to secure the punishment of violators.

The Association was instrumental in the formation of a joint committee composed of representatives of architects, engineers, builders and insurance men's organizations. This joint committee has had prepared and presented to the Forty-sixth General Assembly, the "Church Bill," providing for a State Building Law Commission to investigate state building conditions and prepare a state building law for presentation to the Forty-seventh General Assembly. This bill was passed by both House and Senate, but failed to receive the signature of the governor, due to certain legal defects. It is hoped that these defects can be corrected by the special session of the Legislature, so that the bill can be endorsed by the governor and become a law.

There is great need of uniform building laws throughout the state. At present, there is much contradiction between the laws that obtain in different localities. Also there is general deficiency in law in most of the smaller sized towns and cities and general laxity of enforcement, the general impression being that local building laws are especially designed for enforcement against out-of-town owners and contractors. There is also much contradiction between the various state and municipal building regulations, due to the fact that such regulations have not been properly considered by a commission of experts who would be able to determine the effect of any proposed law.

There is no more reason why a place

of public assemblage, or any other building, should be built and maintained in any place throughout the state, of such form and in such manner as to jeopardize public life, than there would to build one such in any of the larger municipalities where adequate laws for the protection of the public are provided and enforced.

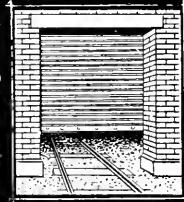
The various architectural societies have been greatly benefited by co-operation in the securing of valuable lecturers, on subjects of importance to architects. During the year, the architectural and arts societies listened to two lectures by Charles R. Ashby of London, England, on the Arts and Crafts movement in England. These lectures were illustrated by lantern slides showing Mr. Ashby's own work.

R. Clippston Sturgis of Boston addressed the three architectural societies of Chicago on "Small Houses and Their Grounds." This address was illustrated by stereopticon views of English residences and grounds and was particularly helpful to architects engaged in residence work, and instructive and entertaining to all. These societies were also addressed by Mr. Walter Scott Perry of Brooklyn, N. Y., on the "Life, Religion and Architecture of the Hindus, Buddhists and Mohammedans in India." This lecture was illustrated with a large number of lantern slides and was of exceptional educational value.

During the year the Chicago Architects' Business Association listened to a lecture by Mr. L. P. Sibley, secretary National Composition Roofers' Association, on the best methods of constructing composition roofing. Also to a lecture by Mr. P. W. Nelson of New York on "Time an Important Factor in Painting." Both of these lectures were of great practical value to architects.

During the March controversy between contractors and labor the Association declared its views as to the principles which should govern in the settlement of labor disputes. This declaration was mailed on March 29th, 1909, to all architects and building and labor organizations in the state, and it is hoped that same will form a guide for future negotiations between contractors and labor organizations.

At our last annual business meeting, the by-laws of the Association were completely revised to meet the increased scope of the Association's activities.


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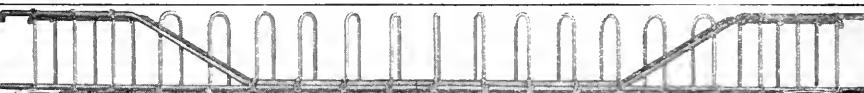
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THE CHICAGO ARCHITECTS' BUSINESS ASSOCIATION CANONS OF PROFESSIONAL ETHICS

Preamble.

The architect is engaged in a profession which carries with it grave responsibilities to the public. These duties and responsibilities cannot be met unless the motives, conduct and ability of the members of the profession are such as to command respect and confidence.

The profession of architecture calls for men of the highest integrity, and executive and artistic ability.

The architect is entrusted with financial undertakings where his honesty of purpose must be above suspicion; he acts as professional adviser to his client, and his advice must be absolutely disinterested; he is charged with the exercise of judicial functions as between client and contractor, and must act with entire impartiality, and he has moral responsibilities toward his professional associates and subordinates.

The people of the State of Illinois have a right to expect a high standard of practice and conduct on the part of the architects whom they have licensed to practice. Because an architect is a quasi public official it is imperative that he assume no obligations which shall place official duty and self-interest in conflict.

The Canons of Ethics.

No set of rules can be framed which particularize all the duties of the architect in his various relations to the public, to his client, to the building trades and to his professional brethren.

The following canons of ethics cover certain broad principles which should govern the conduct of members of the profession and should serve as a guide in circumstances other than those enumerated:

I.—On Certain Duties to the Public.

The architect's more important work is of a character so permanent and enduring that he owes it to the public to use his best efforts to make it such as may raise the standard of taste in the community and be in itself a public ornament. He should design with due regard to surroundings and should endeavor to check any individualism, whether in himself or

his client, that is opposed to the public good. He should take part in those movements for public betterment in which his training and experience enable him to give useful service. He should insist on safe and sanitary construction and he should at all times hold the safe guarding of human life and health as of paramount importance to the interests of client, contractor or self.

II.—On the Architect's Status.

The architect's relation to his client is primarily that of professional advisor. This relation maintains throughout the entire period of his service. When, however, a contract is executed between his client and a builder or other person by the terms of which the architect becomes the official interpreter of its conditions and the judge of its performance, a new relation is created. In respect to the matters under contract, it is incumbent upon the architect to side neither with the client nor contractor, but to endeavor, in so far as his action may determine, that the contract be faithfully carried out according to its true spirit and intent.

It is not proper for the architect to assume to act as the owner's agent unless he has been specifically empowered so to act; by so doing he becomes a party to the contract and in a sense disqualified in his judicial capacity.

The fact that the architect's payment comes through the client does not invalidate his professional obligation to act with impartiality to both parties to the contract. It is essential, however, in order to eliminate the influence of self-interest, that the architect shall not enter into any contract with the client which shall condition his payment upon his decisions or advice.

III.—On Preliminary Drawings and Estimates.

The architect should impress upon his client at the outset the importance of sufficient time for the study and preparation of drawings and specifications. If, on the basis of approved preliminary

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sketches, the approximate cost of the work has been mutually considered, the architect should endeavor to bring his working drawings to meet such approximate cost, provided that his client has requested no departure from the original basis of estimate. But at the same time he should acquaint his client with the conditional character of preliminary estimates. Complete and final figures can be had only from complete and final drawings and specifications. If an unconditional limit of cost is imposed before such drawings are made and estimated, the architect must be free to make such adjustments as seem necessary to that end.

IV.—On Superintendence and Expert Service.

On all work except the simplest, it is to the interest of the client to employ an inspector or clerk-of-the-works; in many engineering problems and in certain esthetic problems such as sculpture, decorative painting, gardening and the like, it is to the interest of the client to have specialized expert service. The architect should so inform the client and assist him in obtaining such service. In order to secure unified and harmonious working organization, only such persons should be selected by the owner for consulting experts as shall work in harmony with the architect and shall be approved by him.

V.—On the Architect's Charges.

The schedule of charges of the Chicago Architect's Business Association is recognized as a proper minimum of payment, but where no other architect is affected it is allowable for an architect to make such an arrangement with his client as is mutually satisfactory. He may not reduce his fee below the schedule of charges in an attempt to supplant another architect; it is reasonable and proper to charge higher rates than those of the schedule when his special skill and the quality of his service justify the increase.

A system of compensation based on the actual cost to the architect on a given piece of work plus an agreed professional fee, has much to commend it.

VI.—On Needless Expenditure.

The architect should scrupulously guard cost, and refrain from introducing need-

less expense or any extravagance in material or construction that may add to cost of building, without compensating gain to the client.

VII.—On Payments for Expert Service.

When retained as an expert, whether in connection with competitions or otherwise, the architect should receive a compensation proportionate to the responsibility and difficulty of the service. No duty of the architect is more exacting than such service, and the honor of the profession is involved in it. Under no circumstances should experts, knowingly, name prices in competition with each other for a given employment. Where governmental regulations prohibit adequate compensation for expert service, it is better to render such service without emolument than to accept a payment out of proportion to the importance of the service rendered.

VIII.—On the Selection of Bidders or Contractors.

The architect should advise his client in the selection of bidders and in the award of contract.

In selecting none but worthy bidders and in advising the award only to contractors who are honest and competent, the architect protects the interests of his client and helps to raise the ethical standard in building.

IX.—On Duties to the Contractor.

On the signing of a contract between owner and builder, the architect is placed in a judicial position and is bound to act with absolute fairness; he is also judge in his own right, deciding whether or not the intent of his plans or specifications is properly carried out, and exercising his judgment as to the true meaning thereof. He should, therefore, take special care to see that these drawings and specifications are complete and accurate, and he should never call upon the contractor to make good his own oversights or errors, or attempt to shirk responsibility by "blanket" clauses.

X.—On Engaging in the Building Trades.

The architect should not engage in any of the building trades, nor should he form any trade partnership or agreement with any person or firm connected therewith;

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nor should he have any financial interests in any building material or device of such a nature as to render his professional action liable to a suspicion of self-interest: if he have any interest in building material or device, he should not specify or use the same without the full knowledge and approval of his client.

XI.—On Accepting Commission or Favors.

The architect may not receive any commission or any substantial service or favor from a dealer, a contractor, or from any interested person other than his client.

XII.—On Encouraging Good Workmanship.

In his authority to interpret and enforce the provisions of the contract, the architect is vested with large powers which he should use with unbiased judgment. While he must condemn bad work, he should also make a point of commending that which is good.

Intelligent initiative, artistic or mechanical, on the part of craftsmen and workmen, should be promptly recognized and encouraged, and the architect should make evident his appreciation of the dignity and importance of their work.

XIII.—On Offering Service Gratuitously.

The offering of professional service on approval, unless warranted by personal or previous business relations, tends to lower the dignity and standing of the profession: also to provide motive for dishonest representation and is to be condemned.

XIV.—On Advertising.

Advertising in any form is to be discouraged as tending to lower the standing of the profession. The presentation of ordinary business cards is a matter of individual taste and not per se improper; but the solicitation of work by circulars or advertisements and the inspiring or inserting of self-laudatory notice in the press are unprofessional.

The best recommendation of an architect is a well-merited reputation for professional capacity and fidelity to trust.

XV.—On Signing Buildings and Use of Titles.

The signing of buildings has the indorsement of the Chicago Architect's Business Association. The use of the initials designating degrees or technical society membership is proper in connection with any professional service and is encouraged as helping to make known the nature of the honor they imply.

XVI.—On Competitions.

In no way does the architect come more conspicuously before the public than through competitions. It is especially desirable that in such circumstances he should conduct himself with self-respect and dignity. To under value and cheapen his service or to compete where a just

award is not safe guarded is inconsistent with this position. Competitions are undesirable from the standpoint of both the client and the architect and a member of the Association should discourage the holding of same. If a competition becomes inevitable, because of governmental regulations, he should not enter either as a competitor or a professional advisor unless the competition is to be conducted according to the best practice and usage of the profession as formulated from time to time by the American Institute of Architects. Except as an authorized competitor he may not attempt to secure work for which competition has been instituted.

He may not present drawings to secure work for which competition has been closed but not decided.

He may not attempt to influence the award in any competition.

XVII.—On the Expert's Future Status.

An architect may not undertake a further commission on any building or work after having acted in an expert capacity in formulating a program which later is put into effect, or after having acted in an advisory capacity in the matter of awards in competition. Having acted in either or both of such capacities should bar an architect from eligibility to execute commissions upon the work in question.

XVIII.—On Criticising the Work of Others.

An architect may not criticise publicly in the press the work of a fellow architect except over his own signature, or editorially; and he may not intentionally injure, directly or indirectly, the reputation, prospects or business of a fellow architect.

XIX.—On Undertaking the Work of Another.

An architect may not undertake a commission while the just claim of a fellow architect, who had previously undertaken it, remains unsatisfied; nor may he attempt to supplant a fellow architect or to obtain a commission after steps have been taken toward the appointment of another architect.

XX.—On Duties Toward the Student Draughtsman.

It is the duty of the architect to advise and assist those who intend making architecture their career. The intending student should be urged to secure a preparation of broad general culture equivalent to that required for the degree of A. B., concurrently with or followed by a thorough course in a well organized school of architecture.

In cases where such preparation is out of the question and the beginner must get his training in the office of an architect, the latter should assist him to the best of

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his ability by instruction and advice. An architect, should, as far as possible, urge his draughtsmen to avail themselves of educational opportunities. To this end he should give encouragement to all worthy schemes and institutions for architectural education.

Members of the association cannot too strongly insist that a thorough technical preparation for the practice of architecture should rest upon a foundation of general culture.

XXI.—On Duties Toward Building Authorities.

The architect should support all federal, state and municipal officials who have charge of matters relating to building and endeavor to maintain or improve the standards of their departments. His quasi public official capacity requires him to show respect for law by careful and conscientious compliance with all building regulations, and if any such appear to him unwise or unfair, he should endeavor to have such regulations altered, but until so altered he should comply with them. An architect because of his official relation to the state and of his moral obligation should not even under his client's instructions encourage any practices contrary to law or hostile to public interests; for he is not obliged to accept a given piece of work, hence he cannot urge in extenuation and to escape the condemnation attaching to his acts that he has but followed his client's instructions.

XXII.—On Professional Qualifications.

The assumption of the title of architect should be held to mean that the bearer has the professional knowledge, both theoretical and practical, and the natural ability needed for the proper invention, illustration and supervision of all building operations which he may undertake.

XXIII.—On Matters Adjudged Unprofessional.

The following code, based on a report of a special committee of the American Institute of Architects, is adopted by the Chicago Architects' Business Association as a general guide, yet the enumeration

of particular duties should not be construed as the denial of the existence of others equally imperative though not specifically mentioned. It should also be noted that these sections indicate offenses of greatly varying degrees of gravity:

It is unprofessional for an architect—

1. To engage in any of the building trades or to form any trade partnership or agreement with any person or firm engaged therein.

2. To guarantee an estimate or contract by bond or otherwise.

3. To accept a commission or any substantial service or favor from a contractor, or anyone connected with the building trades.

4. To advertise in any form.

5. To enter any competition the terms of which are not in harmony with principles approved by the American Institute, especially if such terms have been specifically condemned by the American Institute or a local chapter thereof.

6. To attempt in any way except as a duly authorized competitor to secure work for which a competition has been instituted.

7. To attempt to influence the award of a competition.

8. To injure intentionally the fair reputation, prospects or business of another architect.

9. To criticise anonymously in the public prints, except editorially, the professional conduct or work of a fellow architect.

10. To undertake a commission while the just claim of another architect who has previously undertaken it remains unsatisfied.

11. To attempt to supplant a fellow architect after definite steps have been taken toward his employment.

12. To offer or perform services at rates lower than those approved as minimum by the Chicago Architects' Business Association in an attempt to supplant or underbid another architect.

13. To act in a manner detrimental to the best interests of the profession.

SCHEDULE OF PROPER MINIMUM CHARGES AND PROFESSIONAL PRACTICE OF ARCHITECTS RECOMMENDED BY THE CHICAGO ARCHITECTS' BUSINESS ASSOCIATION

1. The architect's professional services consist of the necessary conferences, the preparation of preliminary studies, working drawings, specifications, large scale and full size detail drawings, and of the general direction and supervision of the work, for which, except as hereinafter mentioned, the minimum charge, based

upon the total cost of the work complete, is six per cent. **Total cost** is to be interpreted as the cost of all materials and labor necessary to complete the work, plus contractors' profits and expenses, as such cost would be if all materials were new and all labor fully paid, at market prices current when the work was ordered.

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2. On residential work, on alterations to existing buildings, on monuments, furniture, decorative and cabinet work, and landscape architecture, it is proper to make a higher charge than above indicated.

3. The architect is entitled to compensation for articles purchased under his direction, even though not designed by him.

4. If an operation is conducted under separate contracts, rather than under a general contract, it is proper to charge a special fee in addition to the charges mentioned elsewhere in this schedule.

5. Where the architect is not otherwise retained, consultation fees for professional advice are to be paid in proportion to the importance of the questions involved and services rendered.

6. Where heating, ventilating, mechanical, structural, electrical and sanitary problems are of such a nature as to require the services of a specialist, the owner is to pay for such services in addition to the architect's regular commission. Chemical and mechanical tests and surveys, when required, are to be paid for by the owner.

7. Necessary traveling expenses are to be paid by the owner.

8. If, after a definite scheme has been approved, changes in drawings, specifications or other documents are required by the owner; or if the architect be put to extra labor or expense by the delinquency or insolvency of a contractor, the architect shall be paid for such additional services and expense.

9. The architect's entire fee is itemized and proportionate payments on account are due the architect, as the following items are completed:

| | |
|------------------------------------|---|
| Preliminary Studies | 2 |
| General drawings | 2 |
| Specifications | 1 |
| Scale and full size details..... | 2 |
| General Supervision of the work... | 3 |

10. Items of service are comprehended as follows:

(a) **Preliminary Studies** consist of the necessary conferences, inspections, studies and sketches modified and remodified to determine the client's problem and illustrate a satisfactory general solution of same, both as to plan and elevation. Illustrative sketches for this purpose need not be to accurate scale, but should be approximately correct as to general dimensions and proportion.

(b) **General Drawings** include figured scale plans of the various stories, elevations of all the fronts, such general vertical sections as may be necessary to elucidate

the design, and such details, drawn to still larger scale as, with the assistance of printed notes, and of the accompanying specifications, may make the whole scheme clearly evident to the mind of the competent builder and give him a full and complete comprehension of all the structure conditions as they affect the vital questions of quality and quantity of materials, of character of workmanship, and of cost.

(c) **Specifications** consist of a supplementary statement in words, of at least all those items of information regarding a proposed building which are not set forth in the drawings.

(d) **Detail Drawings** include all the necessary supplementary drawings required for the use of the builders, to enable them to so provide and shape their material that it may be adjusted to its proper place or function in the building with the least delay, and the smallest chance for errors and misfits. If not prepared until after the contract for the building is let they must not impose on the contractor any labor or material which is not called for by the spirit and intent of the "General Drawings" and "Specifications."

(e) The **Supervision** of an architect (as distinguished from the continuous personal superintendence which may be secured by the employment of a clerk-of-works or inspector of construction) means such inspection by the architect or his deputy, of work in studios and shops or a building or other work in process of erection, completion or alteration, as he finds necessary to ascertain whether it is being executed in general conformity with his drawings and specifications or directions. He has authority to reject any part of the work which does not so conform and to order its removal and reconstruction. He has authority to act in emergencies that may arise in the course of construction, to order necessary changes, and to define the intent and meaning of the drawings and specifications. On operations where a clerk-of-works or inspector of construction is required, the architect shall employ such assistance at the owner's expense.

11. Drawings and specifications, as instruments of service, are the property of the architect.

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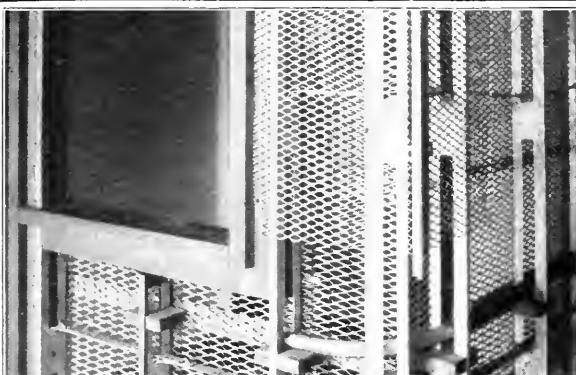
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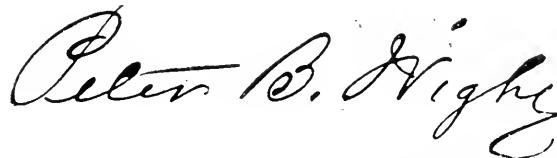
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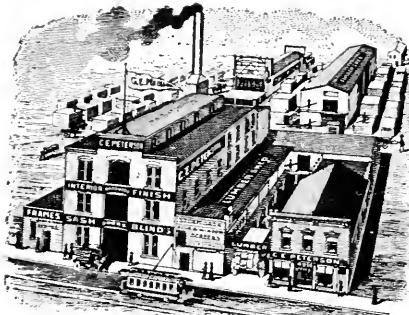
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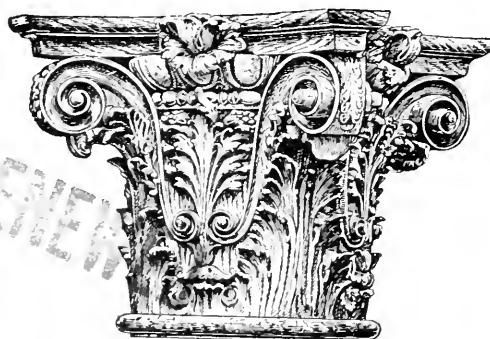
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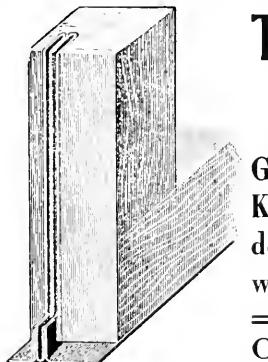
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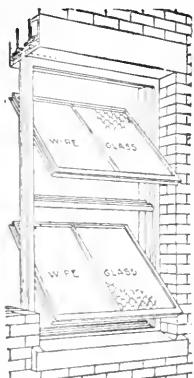
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| M. J. DOHERTY | Superintendent of Streets. |
| WM. E. QUINN (in charge)..... | Bureau of Sewers. |
| ELTON LOWER | |
| HIRAM D. FARGO..... | Civil Service. |
| M. L. McKINLEY..... | |
| PERCY B. COFFIN | Secretary of Civil Commission. |
| MURDOCH CAMPBELL..... | Building Commissioner. |
| GEO. M. SHIPPY..... | Chief of Police. |
| HERMAN F. SCHUETTLER..... | Assistant Chief of Police. |
| EDWARD J. BRUNDAGE..... | Corporation Counsel. |
| JOHN R. CAVERLY..... | City Attorney. |
| GEO. WHITE | City Prosecutor. |
| JOHN D. REILLY..... | Map Department. |
| FRANCIS A. EASTMAN..... | City Statistician. |
| PATRICK WHITE | Superintendent of Bridges. |
| L. BLAKE BALDWIN | City Physician. |
| WM. J. McCOURT..... | Superintendent Bureau of Water. |
| P. D. O'BRIEN | Detective Department. |
| JOHN J. HOULIHAN..... | Boiler Inspector. |
| L. P. BIRD..... | Smoke Inspector. |
| WM. B. BURKE..... | Gas Inspector. |
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| WM. J. BURNS..... | Vice-President |
| J. J. HOULIHAN..... | Secretary |
| A. J. MURRAY | Superintendent of Sidewalks. |
| CHAS. B. BALL..... | Chief of Sanitary Department. |
| EDWARD PRITCHARD | Secretary Health Department. |
| SIMON MAYER | Secretary of Police. |
| JOHN ERICSON | City Engineer. |
| H. S. DIETRICH (President)..... | |
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| JOHN MINWEGEN | Board of Local Improvements. |
| ALBERT F. KEENEY | |
| FELIX NORDEN..... | |
| CHAS. V. STANDISH..... | Secretary Board Local Improvements. |
| FRANK SOLON | Superintendent of Streets and Alleys |
| | Cleaning Department. |

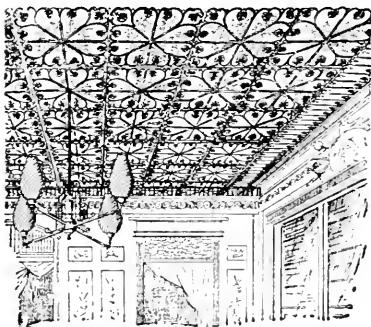
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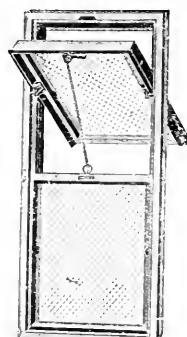
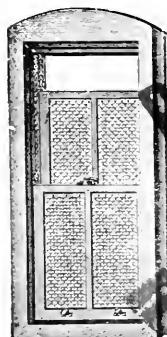
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PETER B. WIGHT, Secretary

Members

INSTITUTE MEMBERS

Address

Date of Election

| | | | |
|-------------|------------------------|--|------|
| F. A. I. A. | Beaumont, George | 115 Dearborn St. | 1890 |
| F. A. I. A. | Beman, S. S. | 237 Michigan Ave. | 1890 |
| F. A. I. A. | Berlin, Robert C. | 153 La Salle St. | 1890 |
| F. A. I. A. | Burnham, D. H. | Railway Exchange | 1894 |
| A. A. I. A. | Case, John W. | Engineering Hall, U. of I., Urbana, Ill. | 1907 |
| F. A. I. A. | Clay, W. W. | 218 La Salle St. | 1891 |
| F. A. I. A. | Coolidge, Chas. A. | 1614-206 La Salle St. | 1896 |
| A. A. I. A. | Crowen, Samuel N. | Stock Exchange Bldg. | 1907 |
| A. A. I. A. | Dinkelberg, F. P. | 135 Adams St. | 1907 |
| A. A. I. A. | Fellows, Wm. K. | 1733 Marquette Bldg. | 1890 |
| F. A. I. A. | Flanders, J. J. | 70 Dearborn St. | 1890 |
| A. A. I. A. | Fletcher, Robert C. | 172 Washington St. | 1901 |
| F. A. I. A. | Frost, Chas. S. | Borland Bldg. | 1891 |
| F. A. I. A. | Granger, Alfred Hoyt | Borland Bldg. | 1907 |
| F. A. I. A. | Hallberg, L. G. | 805-84 La Salle St. | 1890 |
| F. A. I. A. | Hill, Henry W. | 70 La Salle St. | 1890 |
| F. A. I. A. | Holabird, William | 1618 Monadnock Bld. | 1890 |
| A. A. I. A. | Jensen, Elmer C. | 1401 New York Life Bldg. | 1908 |
| A. A. I. A. | Krause, Edmund R. | Majestic Theater Bldg. | 1895 |
| A. A. I. A. | Maher, George W. | 218 La Salle St. | 1907 |
| F. A. I. A. | Mundie, W. B. | 171 La Salle St. | 1893 |
| A. A. I. A. | Nimmons, George C. | 1733 Marquette Bldg. | 1903 |
| F. A. I. A. | Otis, Wm. A. | 175 Dearborn St. | 1890 |
| F. A. I. A. | Patton, N. S. | 153 La Salle St. | 1892 |
| A. A. I. A. | Perkins, Dwight Heald | Hartford Bldg. | 1894 |
| F. A. I. A. | Perkins, Frederick W. | 46 Van Buren St. | 1891 |
| A. A. I. A. | Pond, A. B. | 1109 Steinway Hall | 1902 |
| F. A. I. A. | Pond, I. K. | 1109 Steinway Hall | 1902 |
| F. A. I. A. | Quackenbush, L. G. | 103 Fifth Ave. | 1890 |
| F. A. I. A. | Ricker, N. Clifford | Urbana, Ill. | 1907 |
| F. A. I. A. | Roche, M. | 1618 Monadnock Bld. | 1890 |
| F. A. I. A. | Schmidt, Richard E. | 172 Washington St. | 1905 |
| F. A. I. A. | Shaw, Howard Van Doren | 172-161 State St. | 1903 |
| A. A. I. A. | Shepardson, Ralph S. | Coulter Bld., Aurora, Ill. | 1907 |
| A. A. I. A. | Spencer, Robert C. | 1200 Steinway Hall | 1906 |
| A. A. I. A. | Stanhope, Leon E. | 184 La Salle St. | 1904 |
| F. A. I. A. | Treat, S. A. | 279 Dearborn St. | 1890 |
| A. A. I. A. | Vail, Morrison H. | 111 Dixon, Ill. | 1905 |
| A. A. I. A. | Waterman, H. H. | 218 La Salle St. | 1901 |
| A. A. I. A. | Weber, P. J. | Fisher Bldg. | 1904 |
| A. A. I. A. | Wheelock, H. B. | Schiller Bldg. | 1894 |
| F. A. I. A. | Wight, Peter B. | 1112 Chamber of Commerce Bldg. | 1893 |
| A. A. I. A. | Worst, F. W. | Aurora, Ill. | 1907 |
| A. A. I. A. | Woltersdorf, A. F. | 70 La Salle St. | 1902 |
| F. A. I. A. | Zimmermann, W. Carlys. | 1101 Steinway Hall | 1894 |

HONORARY MEMBERS

| Members | Address | Date of Election | Members | Address | Date of Election |
|----------------|--------------------|------------------|-------------------|--------------------------|------------------|
| Baumann, Fred. | 43 Pine Grove Ave. | 1900 | Whitehouse, F. M. | ..... | ..... |
| Matz, Otto | 78 LaSalle St. | 1902 | ..... | 1 Madison Ave., New York | 1907 |

CHAPTER MEMBERS

| Members | Address | Date of Election | Members | Address | Date of Election |
|------------------------|-------------------------------|------------------|--------------------------|----------------------|------------------|
| Barnes, Julian | 153 La Salle St. | 1908 | Oswald, Fridolin | Alhambra, Ill. | 1907 |
| Brinkman, Wm. J. | Ashland Blk. | 1908 | Ottenheimer, H. L. | ..... | ..... |
| Brush, C. E. | 1654 Monadnock Blk. | 1898 | ..... | Fort Dearborn Bldg. | 1907 |
| Carpenter, Frank A. | Rockford, Ill. | 1907 | Powers, Horace S. | 1200 Steinway Hall | 1905 |
| Clark, William Jerome | ..... | ..... | Prindeville, Chas. W. | 17 Van Buren | 1908 |
| Colcord, Albert E. | 206 La Salle St. | 1906 | Renwick, Edward A. | ..... | ..... |
| ..... | 611-10 Dearborn St. | 1896 | ..... | 1618 Monadnock Blk. | 1904 |
| Dunderdale, George | 1507 Fisher Bldg. | 1905 | Rogers, John Arthur | ..... | ..... |
| Egan, James J. | 17 Van Buren St. | 1908 | ..... | 1615 Ashland Blk. | .... |
| Graham, Ernest R. | Railway Exchange | 1904 | Schmid, Richard G. | ..... | ..... |
| Hall, Emery Stanford | 153 La Salle St. | 1908 | ..... | 59 Metropolitan Blk. | 1898 |
| Hamilton, John L. | 110 Dearborn St. | 1906 | Shattuck, Walter F. | 218 La Salle St. | 1909 |
| Holden, Ben Edwin | ..... | 1905 | Smith, Wm. Jones | ..... | ..... |
| ..... | 1800 Railway Exchange | 1905 | ..... | 1618 Monadnock Blk. | 1909 |
| Holmes, Morris G. | 140 Dearborn St. | 1905 | Tomlinson, Henry Webster | ..... | ..... |
| Hoskins, John M. | 1280 W. Madison St. | 1901 | ..... | 809 Steinway Hall | 1906 |
| Hueh, H. W. | 59 Metropolitan Blk. | 1898 | Van Osdel, J. M. | 225 Dearborn St. | 1890 |
| Marshall, B. H. | ..... | 1907 | White, Chas. Elmer, Jr. | Oak Park, Ill. | 1907 |
| ..... | 934 First National Bank Bldg. | 1906 | Winslow, Benjamin E. | 1650 Ashland Blk. | 1908 |
| Matteson, Andre Victor | La Salle, Ill. | 1902 | Waterbury, Chas. D. | ..... | ..... |
| Morehouse, M. J. | 702 Fisher Bldg. | 1902 | | 1104 Steinway Hall | 1909 |
| F. A. I. A. Fellows. | | | Woodlyatt, Ernest | 1815 Ashland Blk. | 1909 |
| | | | A. A. I. A. Associate. | | |

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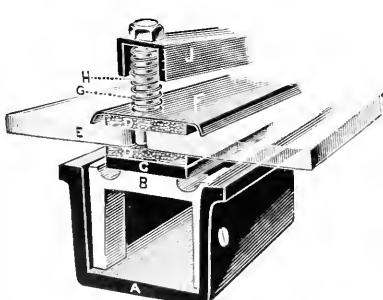
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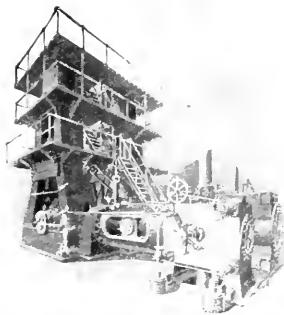
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|---|---------------------------------------|
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| H. C. CHATFIELD-TAYLOR..... | Lake Forest, Ill. |
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| MRS. GEORGE B. CARPENTER..... | Chicago Beach Hotel |
| WILLIAM H. BUSSE..... | 248 Adams Street |
| N. H. CARPENTER..... | Art Institute |
| CHAS. L. HUTCHINSON..... | Corn Exchange Nat'l Bank, The Rookery |
| EAMES MAC VEAGH..... | 103 Lake Shore Drive |
| HOWARD VAN D. SHAW..... | 163 State Street |
| J. S. DICKERSON..... | 324 Dearborn Street |
| CHARLES J. MULLIGAN..... | 722 S. Ridgeway Avenue |
| JENS JENSEN | West Park Board, Office Union Park |
| BRYAN LATHROP, Lincoln Park Board..... | Old Colony Building |
| JULIA BRACKEN WENDT..... | Los Angeles, Cal. |
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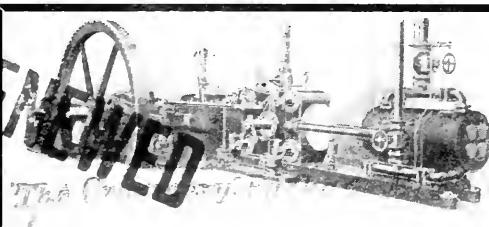
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BUILDING ORDINANCES OF THE CITY OF CHICAGO

As contained in Chapter XV of the revised Municipal Code of Chicago (passed March 20, 1905, published April 15, 1905), together with all amendments up to and including July 6, 1909.

All amendments and additions will be found printed in italics under proper Section numbers, except the Fire Limits Ord. (Sec. 686) and Ord. covering Bill and Sign Boards and Fences (Sec. 705 to 715).

CHAPTER FIFTEEN

ARTICLE I.

OFFICERS—POWERS AND DUTIES.

Section 199. (**Department of Buildings Established.—Officers.**)—There is hereby established an executive department of the municipal government of the city, which shall be known as the Department of Buildings, and shall embrace a Commissioner of Buildings, a Deputy Commissioner of Buildings, an Assistant Deputy Commissioner of Buildings, a Civil Engineer, a Secretary to the Commissioner, a Chief Building Inspector, and such Inspectors of Elevators, Inspectors of Stand Pipes and Fire Escapes, and Inspectors of Buildings, and such other assistants and employes as the City Council may by ordinance provide.

Sec. 200. (**Building Commissioner.—Office Created.—Appointment.—Bond.**)—There is hereby created the office of Commissioner of Buildings. He shall be the head of said Department of Buildings, and shall be an experienced architect, civil engineer, builder, or competent building mechanic, and shall have been engaged in the city as an architect, civil engineer, builder or building mechanic for a period of ten years, and during his term of office as Commissioner of Buildings, he shall not be engaged in any other business.

He shall be appointed by the Mayor, by and with the advice and consent of the City Council.

The Commissioner of Buildings, before entering upon the duties of his office, shall execute a bond to the City in the sum of twenty-five thousand dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of his duties as the Commissioner of Buildings.

As amended by ordinance Feb. 3, 1908.

Sec. 201. (**Powers.—Appointment of Subordinates.—Bonds.—Duties of Commissioner.**)—He shall have the management and control of all matters and things pertaining to the Department of Buildings, and shall appoint, according to law, all subordinate officers and assistants in his department and may remove them according to law. All subordinate officers, assistants, clerks and employes in said Department shall be subject to such rules and regulations as shall be prescribed from time to time by said Commissioner.

It shall be the duty of said Commissioner to enforce all ordinances relating to the erection, construction, alteration, repair, removal or the safety of buildings.

Sec. 202. (**Precautions in Behalf of Public Safety.—May Require Repair or Alteration in Such Cases.**)—Amended by ordinance Feb. 3, 1908, to read as follows:

It shall be the duty of the Commissioner of Buildings, when any citizen represents that ashes or combustible materials are kept in any place in the City in an insecure manner, or that the doors, stairways, corridors, exits, or fire escapes in any factory or workshop or other place of employment are insufficient for the escape of employes in case of fire, panic, or accident, or do not comply with the provisions of this chapter or that the funnels, flues, fire boxes, or heating apparatus in any building in the City are insecure or dangerous, or that any part of any building in the City is in an unsafe or dangerous condition, or in any

wise in contravention of this chapter, to make an examination of such place or building, and if such representation is found to be true, said Commissioner shall give notice in writing to the owner, occupant, lessee or person in possession, charge or control of such place or building to make such changes, alterations or repairs as public safety or the ordinance of the City may require.

Upon failure of parties so notified to comply with said notice, the matter shall be placed in the Law Department for prosecution.

Sec. 203. (Access to all Buildings for the Purpose of Investigating Complaints.—Interpretation of this Chapter.)—Amended by ordinance Feb. 3, 1908, to read as follows:

The Commissioner of Buildings, or his representatives, shall have access to all public school buildings, public halls, churches, theaters, and all buildings used either for manufacturing or commercial purposes, also all hotels, apartment houses and other buildings occupied by large numbers of people, where any complaint is made concerning the safety of such buildings, or any parts or appliances or equipment thereof; for the purpose of investigating and determining the sufficiency of their doors, passageways, aisles, stairways, corridors, exits, or fire escapes, and generally their facilities for egress in case of fire or other accident, and the strength of their floors, and shall make return of all violations of several provisions of this chapter to the Law Department for prosecution.

The Commissioner of Buildings shall have full power to pass upon any question arising under the provisions of this chapter subject to the conditions, modifications and limitations contained therein.

Sec. 204. (Inspection of Elevators.—Power to Stop Use of Same.)—The Commissioner of Buildings shall have power to prohibit and stop the use of any passenger or freight elevator when any Inspector of Elevators shall report to him that such elevator or the hoistway in which it is used is in a dangerous or unsafe condition. Such prohibition of use shall continue in force until such hoistway or elevator, or both, shall have been put in a safe condition, and certified to be safe after a proper inspection thereof by the Inspector of Elevators.

Sec. 205. (Buildings Found in Unsafe Condition.—Notice to Owner.—Authority of Commissioner.)—If the Commissioner of Buildings shall find in the city any building or structure or part thereof in such an unsafe condition as to endanger life, but so that, by the immediate application of precautionary measures such danger may be averted, he shall have authority, and it shall be his duty to forthwith notify in writing, the owner, agent, or person in possession, charge or control of such building or structure or part thereof to adopt and put into effect such precautionary measures as may be necessary or advisable in order to place such building or structure or part thereof in a safe condition. Such notice shall state briefly the nature of the work required to be done, and said Commissioner shall specify in such notice a time within which the work required to be done shall be completed by the person notified, such time to be fixed by said Commissioner upon taking into consideration the condition of such building or structure, or part thereof, and the danger to life or property which may result from its unsafe condition.

If the owner, agent or person in possession, charge or control of such building or structure, or part thereof, when so notified, shall fail, neglect or refuse to place such building or structure, or part thereof, in a safe condition, and to adopt such precautionary measures as shall have been specified by said Commissioner within the time specified in such notice, in such case, at the expiration of such time, it shall be the duty of said Commissioner to proceed forthwith to do, or cause to be done, any and all work necessary to place such building or structure, or part thereof, in a safe condition.

If the said commissioner shall be unable to find the owner of such building, structure, or part thereof, or any agent or person in possession, charge or control thereof, upon whom such notice may be served, he shall place or cause to be placed the notice herein provided for, upon such building at or near its principal entrance, and if, at the expiration of the time specified in such notice for the completion of the work required to be done the terms of such notice shall not have been complied with, it shall be the duty of the Commissioner to thereupon proceed and do such work in the same manner as has hereinbefore been provided in cases of refusal, neglect or failure on the part of the owner, agent or person in possession, charge or control of any such building, structure or part thereof, when so notified.

If, in accordance with the provisions of this section, the work of placing any building, structure, or part thereof in a safe condition shall devolve upon the said commissioner, and it shall appear that such building, structure or part thereof is in such a condition as not to warrant the expenditure thereon of a sufficient sum of money to make such repairs or to do such work as is necessary to put it in a safe condition, the said Commissioner shall have authority to tear down or destroy such building or structure or part thereof, and the expense of tearing down and destroying any such

building or structure or part thereof, and the expense of making any repairs or doing any work thereon shall be charged to the person owning or in possession, charge or control of such building or structure or part thereof, and the Commissioner shall recover or cause to be recovered from such owner or person in possession, charge or control the cost to the city of doing such work.

Sec. 206. (Building or Part of Building Constructed in Violation of Chapter.—Authority of Commissioner to Tear Down.)—If it shall be found that any building or structure or part thereof is being or shall have been constructed or built in violation of any of the provisions of this chapter, the Commissioner of Buildings shall forthwith notify the owner, agent, superintendent or architect of, or the contractor engaged in erecting such building or structure, or part thereof, of the fact that such building or structure, or part thereof, has been, or is being, constructed or erected contrary to the provisions of this chapter, and shall specify briefly in such notice in what manner the provisions of this chapter, or any of them, have been violated, and shall require the person so notified to forthwith make such building, structure, or part thereof, conform to and comply with the provisions of this chapter, specifying in such notice the time within which such work shall be done.

If, at the expiration of the time set forth in such notice, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and to have such building or structure, or part thereof, concerning which notice was sent, changed so as to conform to and comply with the provisions of this chapter, the Commissioner of Buildings shall have the authority, and it shall be his duty, to proceed forthwith to tear down or cause to be torn down such building or structure, or such part thereof as shall or may have been erected and constructed in violation of the provisions or any of the provisions of this chapter, and the cost of such work shall be charged to and recovered from the owner of such building or structure or from the person for whom such building or structure is being erected.

Sec. 207. (May Direct Fire Department to Remove.)—The Commissioner of Buildings shall also have authority to direct the Fire Department, after written notice has been served upon the owner, lessee, occupant, agent or person in possession, charge or control, personally, to tear down any defective or dangerous wall or any building or any part thereof which may be constructed in violation of the terms of this chapter. In case of the destruction, or partial destruction, of buildings by fire or by the action of the elements, when any department of the city government, pursuant to the ordinances of the city, shall make any outlay of money or incur any liability for the payment of any expense on behalf of the city in an effort to preserve or prevent the destruction of any such building or buildings, or for the preservation of the life or health of its citizens, it shall be the duty of the Commissioner of Buildings to ascertain the amount of such outlay or expenditure and present a bill therefor to the owner or owners of any such building or buildings, or his or their agent or agents, and it shall be the duty of the said Commissioner of Buildings to refuse to issue a permit for the reconstruction, alteration or repair of any such building or buildings by such owner or owners until such outlay or expenditure shall be repaid to the city by the owner or owners of such building or buildings so totally or partially destroyed in the manner aforesaid. Said Commissioner shall also proceed forthwith to collect from such owner or owners, by appropriate proceedings, the amount of such bill.

Sec. 208. (May Make Rules for Construction of Buildings and Control of Employes.)—The Commissioner of Buildings shall institute such measures and prescribe such rules and regulations for the control and guidance of his subordinate officers and employes as shall secure the careful inspection of all buildings while in process of construction, alteration, repair or removal and the strict enforcement of the several provisions of this chapter.

Sec. 209. (May Stop Construction and Wrecking of Buildings.)—Amended by ordinance Dec. 11, 1905, to read as follows:

Said Commissioner shall have power to stop the construction of any building or the making of any alterations or repairs of any building within said city when the same is being done in a reckless or careless manner or in violation of any ordinance, and to order, in writing, or by parole, any and all persons in any way or manner whatever engaged in so constructing, altering or repairing any such building, to stop and desist therefrom.

And the said Commissioner shall have power to stop the wrecking or tearing down of any building or structure within said city when the same is being done in a reckless or careless manner or in violation of any ordinance or in such a manner as to endanger life or property, and to order any and all persons engaged in said work to stop and desist therefrom. When such work has been stopped by the order of said Commissioner, it shall not be resumed until said Commissioner shall be satisfied that adequate precautions will be taken for

the protection of life and property, and that said work will be prosecuted carefully and in conformity with the ordinances of the city.

(The penalties prescribed by Section 738, for violations, shall apply with equal force and effect to violations of this section.)

Sec. 210. (Arbitration Appeal from Decision.)—In cases where discretionary power to estimate damage to frame buildings is given the Commissioner of Buildings, as also in questions relating to the security or insecurity of any building or buildings, or parts thereof, and in all other cases where discretionary powers are, by ordinance, given to the Commissioner of Buildings, an appeal to arbitration shall be allowed to parties believing themselves injured or wronged by the decisions of the Commissioner of Buildings, as follows, to wit:

Sec. 211. (Appeal.—Limit of Time of.)—Any person wishing to make such appeal shall do so within five days after written notice of the decision or order of the Commissioner of Buildings has been given him. An appeal made later than five days after the serving of the notice of the Commissioner of Buildings shall not entitle the appellant to an arbitration. The request for arbitration shall be in writing and shall state the object of the proposed arbitration and the name of the person who is to represent the appellant as arbitrator.

Sec. 212. (Appeal.—Cost of.)—The Commissioner of Buildings shall thereupon state to the appellant the cost of such arbitration, and such appellant shall, within twenty-four hours from the time of filing the original request for arbitration, deposit with the Commissioner of Buildings the sum of money required for defraying the expenses of the same, which sum shall in each case be fixed by said Commissioner in proportion to the difficulty and importance of the case, but shall in no case be more than the cost of similar service in the course of ordinary business of private individuals or corporations. As soon as such sum of money shall have been deposited with him the Commissioner of Buildings shall appoint an arbitrator to represent the city, and the two arbitrators thus appointed shall, if they cannot agree, select a third arbitrator, and the decision of any two of these arbitrators shall, after investigation of the matter in question, be final and binding on the appellant as well as upon the city.

Sec. 213. (Arbitrators to Take Oath.—Power to Examine Witnesses.)—The arbitrators shall themselves, before entering upon the discharge of their duties, be placed under oath to the effect that they are unprejudiced as to the matter in question and that they will faithfully discharge the duties of their position. They shall have the power to call witnesses and place them under oath, and their decision or award shall be rendered in writing both to the Commissioner of Buildings and to the appellant from his decision. The fee deposited by the appellant with the Commissioner of Buildings shall be paid by the Commissioner of Buildings to the arbitrators upon the rendering of their report, and shall be in full of all costs incident to the arbitration; but should the decision of said board of arbitration be rendered against the Commissioner of Buildings, then the money deposited by the aforesaid appellant shall be returned to him, and the entire cost of such arbitration shall be paid by the city.

Sec. 214. (In Urgent Cases.—Commissioner's Power Final.)—Whenever the decision of the Commissioner of Buildings upon the safety of any building or any part thereof is made in a case so urgent that failure to properly carry out his orders to demolish or strengthen such building or part thereof may endanger life and limb, the decision and order of the Commissioner of Buildings shall be absolute and final.

Sec. 215. (Duty of Police to Assist Commissioner in Enforcing Provisions of This Chapter.)—Whenever it shall be necessary, in the opinion of the Commissioner of Buildings, to call upon the Department of Police for aid or assistance in carrying out or enforcing any of the provisions of this chapter, he shall have the authority so to do, and it shall be the duty of the Department of Police, or of any member of said Department, when called upon by said Commissioner, to act according to the instructions of, and to perform such duties as may be required by, said Commissioner in order to enforce or put into effect the provisions of this chapter.

Sec. 216. (Certificates.—Notices.—Register.)—The Commissioner of Buildings shall sign or cause to be signed all certificates and notices required to be issued from said Department, and keep a record of the same, and issue or cause to be issued all permits authorized herein. He shall also keep in proper books for that purpose a register of all transactions of the Department of Buildings, which such books shall be open to the inspection of the Mayor, Comptroller, Superintendent of Police, Fire Marshal and members of the City Council at all times.

Sec. 217. (Must Keep Account of Fees Paid.—Annual Reports and Estimates.)—Said Commissioner shall keep, in proper books for that purpose, an accurate account of all fees paid, giving the name of the person paying same, date of payment and amount of each such fee. He shall also annually, on or before the first day of February, in each year, prepare and present to the City Council a report showing the receipts and expenditures and entire work of his Department during the previous fiscal year, and he shall at the same time send to the Comptroller a full and comprehensive statement of all matters pertaining to his Department, together with an estimate in detail of the appropriations required by the Department during the current fiscal year.

Sec. 218. (Deputy Commissioner of Buildings.)—There is hereby created the office of Deputy Commissioner of Buildings. He shall be appointed by the Commissioner of Buildings according to law. Whenever the Commissioner of Buildings shall make requisition upon the Civil Service Commission of the city for a person to fill the office of Deputy Commissioner of Buildings, he shall notify the Civil Service Commission that the person certified to fill said office should be a competent civil engineer, architect or builder.

Sec. 219. (Duties.—Bond.)—Said Deputy Commissioner shall pass upon all questions relating to the strength and durability of buildings; shall examine and approve all plans before a building permit is issued for the construction of any building or structure; shall supervise and have charge of all books and records and the various Inspectors employed in the Department of Buildings; shall receive, examine and file all reports made by them, and shall, under the direction and supervision of the Commissioner of Buildings, assign to such Inspectors the work they are to perform. He shall have a book or books in which shall be recorded the location and character of every building for which a permit is issued, and a copy of every report of inspection made for such building, so arranged that the full history of the various inspections of the building shall appear therein in consecutive order, with the name of each Inspector making the inspection thereof and the date of his report. He shall cause to be kept a record of all complaints of violations of the building ordinances, shall report the same to the Commissioner of Buildings, and shall cause all such complaints to be investigated. He shall act as Commissioner of Buildings in the absence of the Commissioner of Buildings from his office, and while so acting shall discharge all the duties and possess all the powers invested in or imposed upon the Commissioner of Buildings.

He shall before entering upon the duties of his office execute a bond to the city in the sum of ten thousand (\$10,000) dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of the duties of his office.

Sec. 220. (Assistant Deputy Commissioner of Buildings.—Bond.)—There is hereby created the office of Assistant Deputy Commissioner of Buildings. He shall be appointed by the Commissioner of Buildings according to law. Whenever the Commissioner of Buildings shall make requisition upon the Civil Service Commission of the city for a person to fill the office of Assistant Deputy Commissioner of Buildings, he shall notify the Civil Service Commission that the person certified to fill said office should be a competent civil engineer, architect or builder.

The Assistant Deputy Commissioner of Buildings shall, under the direction of the Commissioner of Buildings or the Deputy Commissioner of Buildings, assist and aid the Deputy Commissioner in the performance of his duties.

The Assistant Deputy Commissioner of Buildings, before entering upon the duties of his office, shall execute a bond to the city in the sum of five thousand (\$5,000) dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of the duties of his office.

Sec. 221. (Secretary.—Duties.)—The Commissioner of Buildings shall appoint a Secretary, according to law, whose duty it shall be to preserve and keep, under the supervision and direction of the Deputy Commissioner of Buildings, all books, records and papers belonging to said office or which are required by law to be filed therein. The Secretary shall deliver to the City Council and to the respective departments all communications from said Commissioner, in writing, and perform such services as may be required by said Commissioner or Deputy Commissioner of Buildings.

Sec. 222. (Chief Building Inspector.—Bond.)—There is hereby created the office of Chief Building Inspector. He shall be appointed by the Commissioner of Buildings according to law. Whenever the Commissioner of Buildings shall make requisition upon the Civil Service Commission of the city for a person to fill the office of Chief Building Inspector he shall notify the Civil Service Commission that the person certified to fill said office should be a competent civil engineer, architect or builder.

The Chief Building Inspector shall, under the direction of the Commissioner of Buildings, inspect and examine special cases of violations of the provisions of this chapter, damages to buildings by fire, the elements or accident of any kind whatsoever, and shall perform such other duties as may be required by the Commissioner of Buildings.

or the Deputy Commissioner of Buildings. The Chief Building Inspector, before entering upon the duties of his office, shall execute a bond to the city in the sum of five thousand (\$5,000) dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of the duties of his office.

Sec. 223. (**Inspectors.—Not to Engage in Business.**)—The Inspectors of Buildings, after their appointment to office, shall not be engaged in any other business or vocation.

Sec. 224. (**Inspectors.—Duties.—Reports.—How Made.**)—The said Inspectors shall, under the direction of the Commissioner of Buildings, examine all buildings in the course of erection, alteration, repair or removal throughout the city at least once a week, or as often as may be required for securing efficient supervision, and shall make written reports to said Commissioner as to all violations of any ordinance of the city which the Department of Buildings is required to enforce, together with the street and number where such violations are found, the names of the owner, agent, lessee, or occupant thereof, and of the architect, contractor and master mechanic, engaged in or about the construction of such building and all other matters relative thereto as far as they can ascertain them.

Inspectors of Buildings shall file daily reports of their work of inspection, which shall be entered in the books to be kept for that purpose, and which shall be open to official inspection at all times.

Sec. 225. (**Inspection.—Record of.—How Made.**)—The said Inspectors shall examine all buildings and walls reported dangerous or damaged by fire or accident and make a record of such examinations, with the name of the street and number of the building and of the names of the owner, agent, lessee and occupant thereof.

Sec. 226. (**Alteration, Enlargement or Raising.—Inspection of.—Other Duties.**)—The Inspectors of Buildings shall examine all buildings for which an application to raise, enlarge or alter has been made, and shall make a written report upon the condition of the same to the Commissioner of Buildings before the permit is granted. Said Inspectors shall perform such other duties as may be required of them by said Commissioner of Buildings, the rules and regulations of the Department of Buildings, or the ordinances of the city.

Sec. 227. (**Powers—Other.**)—The Commissioner and Deputy Commissioner of Buildings, as well as the Inspectors of Buildings and of Elevators, are empowered to enter any building, whether completed or in process of erection, for the purpose of determining whether the same has been or is being constructed in accordance with the terms of this chapter, and it shall not be lawful to exclude them from such buildings.

Sec. 228. (**Elevator Inspectors.—Not to Engage in Business.—Duties.**)—The Inspectors of Elevators shall not, after their appointment to office, be employed or engaged in any other business or vocation.

The Inspectors of Elevators shall perform such duties as may be required of them by the Commissioner of Buildings, the rules and regulations of the Department of buildings or the ordinances of the city.

ARTICLE II.

PERMITS, PLANS AND FEES.

Sec. 229. (**Permits.—When Required.—Limitations of Time For.**)—Amended by ordinance Feb. 26, 1906, to read as follows:

Before proceeding with the erection, enlargement, alteration, repair or removal of any building in the city, a permit for such erection, enlargement, alteration, repair or removal shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the erection, enlargement, alteration, repair, or removal of any building or of any structural part thereof within the city unless such permit shall first have been obtained from the Commissioner of Buildings. And, if after such permit shall have been granted, the operations called for by the said permit shall not be begun within six months after the date thereof, or if such operations are not completed within a reasonable time, then such permit shall be void, and no operations thereunder shall be begun or completed until a new permit shall be taken out by the owner or his agent, and fees as herein fixed for the original permit shall be paid for such new permit.

Sec. 230. (**Approval of Architects' Plans.**)—Amended by ordinance Feb. 26, 1906, to read as follows:

In all cases where a licensed architect shall have completed, signed and affixed his seal to plans, drawings or specifications for any building designed to be erected within the corporate limits of the city, or any structural part thereof, for which a building permit must be procured before the same may be erected, the architect making such plans, drawings, or specifications, shall submit same to the Commissioner of Buildings for examination

and approval; and, if the same shall comply with the provisions of this chapter the said Commissioner shall stamp such plans, drawings or specifications in such a manner as to indicate that same have been examined and approved, and the date of such approval, and such stamp shall be preliminary to the final stamp hereinafter provided for.

Said preliminary stamp shall be so affixed before any contract or contracts shall be entered into on behalf of said owner in regard to the construction of said building or buildings on the part of said architect or other person or persons.

Sec. 231. (Permits.—Application For.—How Made.—How Recorded.—Stamped Plans.—How Cared For.—Return of Same.)—Amended by ordinance Feb. 26, 1906, to read as follows:

Application for such permits shall be made by the owner or his agent to the Commissioner of Buildings. When such application is made, plans and specifications in conformity with the provisions of this chapter, which have been examined and approved by said Commissioner as hereinbefore provided for, shall be filed with the Commissioner of Buildings, who shall then issue a permit and shall file such application, and shall apply to such plans and specifications a final official stamp, stating that the drawings and specifications to which the same have been applied comply with the terms of this chapter. The plans and specifications so stamped shall then be returned to such applicant. True copies of so much of such plans and specifications as may be required in the opinion of the Commissioner of Buildings to illustrate the features of construction and equipment of the building referred to, shall be filed with the Commissioner of Buildings and shall remain on file in his office until the completion or occupation of such building, after which such drawings and specifications shall be returned by the Commissioner of Buildings to the person by whom they have been deposited with him upon demand. It shall not be obligatory upon the Commissioner of Buildings to retain such drawings in his custody for more than three months after the completion or occupation of the building to which they relate.

Sec. 232. (Plans.—Essentials Of.)—All such plans and drawings shall be drawn to a scale of not less than one-eighth of an inch to the foot, on paper or cloth, in ink, or by some process that will not fade or obliterate. All distances and dimensions shall be accurately figured, and drawings made explicit and complete, showing the entire sewerage and drain pipes and location of all plumbing fixtures within such building. Each set of plans presented shall be accompanied by a set of specifications describing all materials to be used in the proposed building, and both the plans and specifications shall be approved by the Commissioner of Buildings before a permit will be granted. No permit shall be granted or plans approved unless such plans shall be signed and sealed by a licensed architect, as provided in "An act to provide for the licensing of architects and regulating the practice of architecture as a profession in the State of Illinois," approved June 3, 1897, provided, that permits may be granted for the erection of buildings of Class III., as hereinafter defined, if such building shall not be more than two stories in height and shall have a superficial area of not more than 1,250 square feet outside dimensions, on plans approved by the Commissioner of Buildings, which plans need not be signed by a licensed architect.

Sec. 233. (Plans.—Alterations Upon Stamped Plans Not Permitted Without Permission.—Certain Alterations Excepted.)—It shall be unlawful to erase, alter or modify any lines, figures or coloring contained upon such drawings or specifications so stamped by the Commissioner of Buildings or filed with him for reference. If, during the progress of the execution of such work, it is desired to deviate in any manner affecting the construction or other essentials of the building from the terms of the application, drawing or specification, notice of such intention to alter or deviate shall be given to the Commissioner of Buildings, and his written assent shall first be obtained before such alteration or deviation may be made. Alterations in buildings which do not involve any change in their structural parts or of their stairways, elevators, fire escapes or other means of communication or ingress or egress and that are not in violation of any of the provisions of this chapter may be made without the permission of the Commissioner of Buildings.

Sec. 234. (Deposit With Water Department.—How Made.—Indemnifying Bond.—Fees for Water Used.)—Before the Commissioner of Buildings issues a permit as aforesaid he shall require evidence from the applicant that payment has been made to the Bureau of Water of the city for the water to be used or for a water meter for measuring all the water to be used in the construction of such building, under the regulations of the Bureau of Water. Such applicant shall produce evidence that he has filed with and had approved by the Commissioner of Public Works of the City an indemnifying bond protecting the city against any and all damage that may arise to the streets or alleys upon which such building abuts, and to the city and to any person in consequence or by reason of the proposed operations to be authorized by such permit, or by reason of any obstruction or occupation of any street or sidewalk in and about such building operations.

The fees to be paid for water used in connection with the erection of buildings shall be as follows, to wit:

For water to be used in connection therewith at the rate of five cents for every one thousand bricks, wall measure, used in the construction of a building.

At the rate of six cents for every one hundred cubic feet of rubble stone used in connection therewith.

At the rate of eight cents for every one hundred cubic feet of concrete used in connection therewith.

At the rate of fifteen cents for every one hundred yards of plastering used in connection therewith.

At the rate of five cents for every one hundred cubic feet of hollow tile arch, partition or fireproof covering used in any building.

Sec. 235. (Permits.—Cost of.)—The fees to be charged for building permits shall be as follows: For sheds not exceeding three hundred square feet in area, two dollars; for open shelter sheds, at the rate of fifty cents for each one thousand cubic feet or part thereof; but in no case shall a permit be issued for a less fee than two dollars.

For all buildings **or structures* other than sheds and open shelter sheds, as hereinbefore described, the fee for the permit shall be at the rate of ten cents for every one thousand cubic feet or fractional part thereof contained therein, the cubic contents being measured to include every part of the building from the basement floor to the highest point of the roof and to include all bay-windows and other projections; but in no case shall any permit be issued for a less fee than two dollars, *except that for a permit for shingling a roof of any building the fee shall not exceed one dollar.*

As amended by ordinance of June 5, 1906.

*As amended Nov. 25, 1907.

Section 1. That Section 235 of the Revised Municipal Code of Chicago of 1905, as amended June 5, 1906, be and the same is hereby amended by inserting in line 6 of said section, after the word "buildings," the words "or structures."

Section 2. This ordinance shall be in force and effect from and after its passage.—

As amended Nov. 25, 1907.

Sec. 236. (Permit for Alterations and Repairs.—Cost Of.)—The fee to be charged for permits issued for alterations and repairs in or to any building or structure shall be as follows:

Where such alteration or repair shall equal fifty per cent. or more of the original building or structure to be altered or repaired, or of such part or portion of such building or structure to be altered or repaired, the same fees shall be charged as if such permit were for the construction of a new building.

Where such work of alteration or repair shall be less than fifty per cent. of the original building or structure or of the part or portion to be altered or repaired, the fee to be charged for a permit for such work shall be half that charged for the issuance of a permit for new work.

Sec. 237. The fee for a permit to raise a frame building shall be one dollar.

Sec. 238. (Permits for Raising or Moving Buildings Other Than Frame.)—The fee for a permit to raise or move a building other than a frame building shall be two (\$2) dollars for every twenty-five (25) feet, or fractional part thereof, of frontage, and when such building is to be moved from one location to another it shall be altered or reconstructed so as to conform to the ordinances governing the construction of such building at the time of moving the same.

Sec. 238a. (Permit for Wrecking Building.)—Amended by ordinance of Dec. 2, 1907 (Superseding amendatory ordinance of Dec. 11, 1905), to read as follows:

Before proceeding with the wrecking or tearing down of any building or structure, a permit for such wrecking or tearing down shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the wrecking or tearing down of any building or structure or any structural part thereof within the City unless such permit shall first have been obtained. Application for such permit shall be made by such owner or his agent to the Commissioner of Buildings, who shall issue such permit upon such application and the payment of the fee herein provided for. Such application shall state the location and describe the building which it is proposed to wreck or tear down. The fee for such permit shall be two dollars for every twenty-five feet, or fractional part thereof, of frontage. Upon the issuance of such permit such building may be wrecked or torn down, provided that all the work done thereunder shall be subject to the supervision of the Commissioner of Buildings, and shall be performed under the same restrictions as govern the erection of buildings.

Any person, firm or corporation engaged in the business of wrecking buildings within the City limits shall file with the City Clerk of the City of Chicago an approved bond in the sum of twenty thousand dollars (\$20,000) to indemnify the City against any lawsuits

brought or judgments obtained against the City of Chicago, or any of its officers, resulting from accidents to persons or property during wrecking operations, and shall also procure a contractor's license.

(The penalties prescribed by Section 738, for violations, shall apply with equal force and effect to violations of this section.)

Sec. 239. (Permit.—Revocation Of.)—If work in, upon or about any building shall be conducted in violation of any of the provisions of this chapter, it shall be the duty of the Commissioner of Buildings to revoke the permit for the building operation in connection with which such violation shall have taken place. It shall be unlawful, after the revocation of such permit, to proceed with such building operations unless such permit shall first have been reinstated or reissued by the Commissioner of Buildings. Before a permit so revoked may be lawfully reissued or reinstated the entire building and building site shall first be put into condition corresponding with the requirements of this chapter, and any work or material applied to the same in violation of any of the provisions of this chapter shall be first removed from such building.

ARTICLE III. CLASSIFICATION OF BUILDINGS.

Sec. 240. (Buildings.—Classes Of.)—All buildings (other than sheds and shelter sheds, as hereinafter described) now existing or hereafter constructed, altered or enlarged within the city, shall be classified as follows:

Sec. 241. (Class I.)—In Class I. shall be included every building used for the sale, storage or manufacture of merchandise, other than department stores, as described in Section 247 of this chapter, and all stables covering or occupying a ground area of over five hundred square feet.

Sec. 242. (Class II.)—In Class II. shall be included every office building, hospital and every building used for hotel purposes or for boarding or lodging house purposes where such building so used for hotel or boarding or lodging house purposes is occupied by twenty or more persons.

Sec. 243. (Class III.)—In Class III. shall be included every building used as a family residence, also every building used for stabling purposes where such building so used shall occupy a ground area of less than five hundred square feet.

Sec. 244. (Class IV.)—In Class IV. shall be included every building used as an assembly hall, whether such hall is used for the purpose of worship, instruction or entertainment, unless such building is used for any of the purposes for which buildings of Class V. or Class VIII. are used.

Sec. 245. (Class V.)—In Class V. shall be included every building which is used as a public theater where an admission fee is charged and in which movable scenery is used; provided, however, that public halls and club halls with a seating capacity of less than six hundred, although occasionally used for theatrical representations, shall not be construed to be public theaters within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stage thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V. as herein defined. Such public halls and club halls shall be included in Class IV., as defined in Section 244 of this chapter.

Sec. 246. (Class VI.)—In Class VI. shall be included every tenement and apartment house; that is to say, any house or building or portion thereof which is used as a home or residence for two or more families living in separate apartments.

Sec. 247. (Class VII.)—In Class VII. shall be included all buildings used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as "department stores."

Sec. 248. (Class VIII.)—In Class VIII. shall be included every building used exclusively for school purposes.

Sec. 249. (Buildings Used for the Purposes of More Than One Class.)—Where any building is used for the purposes of two or more classes as herein specified and defined, such portion of any such building as is devoted to the uses and purposes of any particular class shall be constructed, operated and maintained in accordance with the requirements of this chapter relating to such class, unless such construction shall prove impracticable or unless there would be a conflict between the provisions of this chapter relating to the construction of buildings; in either of which such cases the provisions relating to and governing the construction of buildings of the class requiring the best and safest form of construction shall govern.

Sec. 250. (Conflict Between Special and General Provisions.)—Whenever any provision or requirement of this chapter relating specifically to the construction, equipment, maintenance or operation of any building or part of a building used for the

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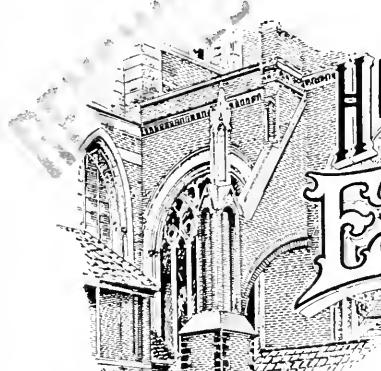
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purposes of any specified class shall conflict with the general provisions of this chapter relating to the construction, operation and equipment of buildings generally, the special provisions shall govern in each case, except in the case of Section 634, which shall govern in all cases coming within its provisions.

ARTICLE IV.

PROVISIONS RELATING SOLELY TO CLASS I.

In Class I. shall be included every building used for the sale, storage or manufacture of merchandise other than department stores, as described in Sections 60 and 700, and all stables covering or occupying a ground area of over five hundred square feet.

Sec. 251. (**Walls of Class I.—Thickness Of.**)—The thickness of surrounding walls and of all dividing walls in every building used wholly or in part for the purposes of Class I. shall be made as indicated in the following table, to wit:

| | Basement. | STORIES | | | | | | | | | | | |
|--------------|-----------|---------|----|----|----|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| One-story | | 12 | 12 | | | | | | | | | | |
| Two-story | | 16 | 12 | 12 | | | | | | | | | |
| Three-story | | 16 | 16 | 12 | 12 | | | | | | | | |
| Four-story | | 20 | 20 | 16 | 16 | 12 | | | | | | | |
| Five-story | | 24 | 20 | 20 | 16 | 16 | 16 | | | | | | |
| Six-story | | 24 | 20 | 20 | 20 | 16 | 16 | 16 | | | | | |
| Seven-story | | 24 | 20 | 20 | 20 | 16 | 16 | 16 | 16 | | | | |
| Eight-story | | 24 | 24 | 24 | 20 | 20 | 16 | 16 | 16 | 16 | | | |
| Nine-story | | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 16 | | |
| Ten-story | | 28 | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 16 |
| Eleven-story | | 28 | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 16 |
| Twelve-story | | 32 | 28 | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 |

Provided, however, in buildings of steel skeleton fireproof construction thickness of walls shall be governed by Section 510 of this chapter.

Sec. 252. (**Buildings.—Height and Construction Of.**)—Buildings of Class I. which are one hundred feet or more in height shall be built entirely of fireproof construction.

Buildings of Class I. less than one hundred feet and more than sixty feet in height shall be built entirely of slow-burning, mill or fireproof construction.

No building of Class I. more than five stories in height shall be permitted to be built of ordinary construction.

Sec. 253. (**Walls.—Exception to Table of Thickness Of.**)—If buildings of Class I. are erected of less depth than 100 feet from front to rear or between cross walls, or if the walls supporting their floors and roofs are less than twenty-five feet apart, the thickness of the walls given in the aforesaid table may be reduced by four inches, excepting only that no wall in such buildings shall be less than twelve inches thick.

Sec. 254. (**Walls.—Metal Lath, and Solid Cement Plaster Covering.**)—A one or two-story building used for the purposes of Class I., no part of which is within twenty feet of any lot line, alley line or street line, having a complete self-supporting steel frame consisting of wall columns supporting steel trusses, with steel trusses and steel diagonals designed to resist safely within the safe limits of stress provided by this chapter a wind pressure of thirty pounds per square foot for each and every exterior surface exposed to the wind, in addition to the dead weight of the completed structure and in addition to the live load of one hundred pounds per square foot provided for by this chapter and any other live loads which may be imposed on said structure, may have exterior walls measuring not less than one and one-third inches thick of metal, lath or metal fabric plastered on both sides with a mortar consisting only of Portland cement and torpedo sand. A complete reinforced concrete framework built in every manner equally as strong and as safe as provided for a steel frame in this section may have exterior walls built in the same manner of the same materials and of the same thickness.

Sec. 255. (**Door Openings at Street Level.—Class I.**)—The aggregate width of door openings at the street level in buildings of Class I. shall be equal to the aggregate width of stairways, as specified in Section 265 of this chapter, and such doors shall not be locked during business hours or while such buildings are occupied by a number of persons for any purpose. Revolving doors shall not be considered as complying with this section, unless the revolving wings of said revolving doors are so arranged that by the application of a force slightly more than necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said doors fold flat on

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each other and in an outward direction, and unless each side, or the half circles of such revolving doors, are hinged and fastened so as to likewise swing backwards on application of force slightly beyond the normal, and which will permit of exit space for two ordinary persons on either side of the collapsed wings of said revolving doors and their inclosing half circles.

As amended by ordinance March 30, 1906.

Sec. 256. (**Buildings of Class I.—Increasing Height Of.**)—In all cases where buildings of Class I., of ordinary construction, already built, are to be increased in height above the height of sixty feet or above the height of one hundred feet, the additional parts of such buildings shall be constructed as herein provided for buildings over sixty feet high or over one hundred feet high, respectively, and shall be made to conform in all respects and throughout their entire extent to the requirements for buildings of this class more than sixty feet or more than one hundred feet high, respectively, before it shall be lawful to occupy them.

Sec. 257. (**Ceilings and Roof of Class I.—Space Between.**)—In buildings of Class I., if the inclosed space between the ceiling and the roof is of greater average height than two feet, easy and convenient means of access, satisfactory to the fire marshal, shall be given to such space.

Sec. 258. (**Fire Walls.—In Buildings of Class I.**)—Buildings occupied by more than one person or corporation, or for more than one business enterprise conducted by the same person or corporation, in separate inclosures on any one floor, shall have a brick dividing wall for every fifty (50) feet of street frontage if of ordinary construction, or for every eighty (80) feet of street frontage if of slow-burning or mill construction, and such dividing walls shall extend from the front to the rear wall, and such dividing walls, and the doors therein shall be built as dividing walls, and the doors therein are required to be built by the provisions of this chapter.

All of the partitions between the parts of such buildings, occupied by different persons or corporations shall be built of incombustible material from the floor to the floor boards or roof boards next above such story or stories so occupied.

Only metal framed windows glazed with one-quarter inch thick fire-resisting glass may be used in such partitions.

Sec. 259. (**Dividing Walls.—When Required in Class I.**)—Dividing walls will be required in buildings of Class I. as follows: For buildings of ordinary construction if their floor area exceeds nine thousand square feet; for buildings of slow-burning or mill construction more than one story in height if their area exceeds twelve thousand square feet; for fireproof buildings more than two stories in height, if their area exceeds twenty-five thousand square feet. In each of the before mentioned cases such buildings shall be subdivided by brick walls built of the thickness given in the table for the thickness of inclosing walls, and all doors and other openings in such walls shall have iron doors or shutters at each side of same. The buildings so subdivided shall be treated as regards stairs and fire escapes the same as two or more separate buildings, provided, however, one-story buildings of ordinary, mill or slow-burning construction or two-story buildings of fireproof construction of any size, used as one store, room or workshop and occupied by only one person or corporation, may be erected without any dividing walls.

Sec. 260. (**Dividing Walls and Iron Doors.—Openings Inserted In.**)—If openings are to be inserted in dividing walls, as before described, or in dividing walls between non-fireproof and fireproof buildings or parts of either of such buildings, they shall be made as follows:

They shall have doors placed on each side of each opening in such walls, which doors shall be made of No. 12 plate iron with a continuous 2 by 2 by one-half-inch angle iron frame extending all around the same and the plate riveted thereto with one-half-inch rivets, placed four inches between centers. If such doors are made double they shall have cross bars, levers and hooks so arranged that when the doors are closed they will be of strength equal to that of a single door. All doors shall be hung on frames made of three-quarter by 4-inch iron stiffened with an angle iron extending all around the same and fitting up snug to the wall. The frames shall be fastened to each other by bolts extending through the wall, such bolts being not more than two feet apart, and such doors shall swing on three hinges and shall be made to fit closely to the frame all around. The sills between the doors shall be of brick, iron, stone or concrete and shall rise at least two inches above the floor on each side of each opening. The lintel over the door shall be made of brick or iron, and the wall between the two door frames shall be covered with a coat of plaster at least one-half inch thick.

Sec. 261. (**Elevator Buildings.—Bins Of.**)—Elevator buildings (which term shall be interpreted as including all buildings intended solely for the receipt, storage and

delivery of grain in bulk) may be constructed with the bin walls, both externally and internally, made entirely of wood; provided such walls are made solid and without cellular open spaces within them. The external bin walls shall have a covering of brick or hollow tile not less than twelve inches thick, which shall be united to the bin walls by anchors, in the construction and arrangement of which due allowance is made for the variations of shrinkage of the inclosing wall and of the wooden bin wall. If the weight of the bins is independently carried on a skeleton construction of timber, steel or iron, the first-story walls shall be of brick not less than twenty inches thick. If the outer walls of the outside bins and their facing are not carried on a skeleton construction, then the first-story wall shall not be less than twenty-eight inches thick, or as much thicker as may be required to keep the load upon the brickwork within the limits of stress elsewhere specified in this chapter. Elevator buildings may be built of reinforced concrete and in such case they shall be built according to the provisions of Section 554 of this chapter.

Sec. 262. (Cupola.—Inclosing Walls Of.—Openings.)—The inclosing walls of cupolas on elevator buildings, if constructed of wood, shall be covered with corrugated iron or other incombustible material.

The outside openings in elevator buildings shall have protections of wire netting made of No. 14 wire, with meshes not over one-half by one-half inch.

All openings in the body of the first story of elevator buildings and the openings in the engine and boiler houses of the same and between these and the main building shall have iron doors made in accordance with the provisions of Section 260 of this chapter.

Sec. 263. (Ventilating Ducts.—Chutes.—Walls Surrounding.)—Walls surrounding ventilating ducts and rubbish and ash chutes shall be constructed in accordance with the regulations governing the construction of smoke flues elsewhere herein contained. Walls around ventilating ducts shall not be less than four inches thick, and when the ventilating duct is larger than 260 square inches the walls shall be not less than eight inches thick.

Sec. 264. (Store Fronts.—Columns and Lintels Supporting.)—The columns and lintels supporting store fronts in buildings within the fire limits of more than one story in height shall be made of incombustible material.

Sec. 265. (Stairs in Buildings of Class I.—Number and Width of.)—Amended by ordinance Nov. 25, 1907, to read as follows:

There shall be in all buildings of Class I of ordinary construction two flights of stairs not less than three feet wide each. For buildings of ordinary construction of Class I and of greater floor area than three thousand square feet, there shall be six inches added to the width of each such flight of stairs for each additional one thousand square feet of floor area or fractional part thereof up to nine thousand square feet of floor area.

Every Class I building of slow-burning or mill construction less than 4,000 square feet floor area shall have two flights of stairs, not less than three feet wide each, and there shall be six inches added to the width of each such flight of stairs for each additional one thousand square feet of floor area, or fractional part thereof, up to twelve thousand square feet. Provided, however, that additional flights of stairs may be used to make the aggregate width required, instead of widening the two flights above mentioned. It is further provided, however, that such stairs may be reduced one foot in width for each four stories in height or fractional part thereof, above the fourth story of such building, but such stairs shall in no case be of less width than three feet.

For fireproof buildings there shall be required two flights of stairs not less than three feet wide for the first three thousand square feet of floor area, or fractional part thereof. For buildings of more than three thousand square feet and not exceeding five thousand square feet of floor area, there shall be required two flights of stairs each not less than three feet six inches in width. For more than five thousand square feet and less than ten thousand square feet of floor area, there shall be an additional flight of stairs not less than three feet in width. For more than ten thousand square feet and less than fifteen thousand square feet of floor area, each of such stairs shall be of not less width than five feet. For more than fifteen thousand square feet and less than twenty-five thousand square feet of floor area there shall be not less than three stairways of an aggregate width of fifteen feet; none of such stairs shall be of less width than three feet.

The width of the different stairways need not be alike. The width of each stairway in the fifth, sixth, seventh and eighth stories may be six inches less in the clear than the width of the stairways in the first to the fourth stories, inclusive.

The width of each stairway in the ninth, tenth, eleventh and twelfth stories may be twelve inches less in the clear than the width of the stairways in the first to the fourth stories, inclusive.

The width of each stairway in the thirteenth, fourteenth, fifteenth and sixteenth stories may be eighteen inches less in the clear than the width of the stairways in the first to the fourth stories, inclusive, and this reduction in width may be continued in the same ratio in each additional four stories added to the height of the building; provided, however, that no stairways shall have a less clear width than three feet.

All stairways in buildings of Class I shall have a hand rail on each side thereof, and where there is more than one stairway in any building of Class I, such stairways shall be located at each end of the building, or as far apart from each other as is practicable.

The width of the different stairways need not be alike. The width of each stairway in the fifth, sixth, seventh and eighth stories may be six (6) inches less in the clear than the width of the stairways in the first to the fourth stories, inclusive.

The width of each stairway in the ninth, tenth, eleventh and twelfth stories may be twelve (12) inches less in the clear than the width of the stairways in the first to the fourth stories, inclusive.

The width of each stairway in the thirteenth, fourteenth, fifteenth and sixteenth stories may be eighteen (18) inches less in the clear than the width of the stairways in the first to the fourth stories, inclusive, and this reduction in width may be continued in the same ratio in each additional four (4) stories added to the height of the building; provided, however, that no stairway shall have a less clear width than three (3) feet.

All stairways in buildings of Class I, shall have a hand rail on each side thereof, and where there is more than one stairway in any building of Class I, such stairways shall be located at each end of the building, or as far apart from each other as is practicable.

Doors and Windows.—When required to be closed, fire-resisting glass. See Section 632.

Limitations In Changing Class of Buildings.—See Section 633.

Buildings Used for the Purposes of More Than One Class.—See Section 249.

Sec. 266. (Courts, Light Shafts and Well Holes.)—Courts, light shafts and well holes shall be built in accordance with the provisions of Section 455 of this chapter.

Sec. 267. (Loads.—Allowance for Live Loads in Construction of Floors of Class I.)—The floors of all buildings of Class I shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, of partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floor; and the strength of such building shall be increased above the capacity to carry each a live load of one hundred pounds per square foot of floor surface when the uses to which such building or part thereof is to be applied involve greater stress.

Sec. 268. (Floors.—Display of Placard Indicating Strength Of.)—It shall be the duty of the owner of every building of Class I, already constructed, or hereafter to be constructed, or of his agent, or of the occupant or person in possession, charge or control of the same, to affix and display conspicuously on each floor of such building a placard stating the load per square foot of floor surface which may with safety be applied to that particular floor, or if the strength of different parts of any floor varies, then there shall be such placards for each varying part of such floor. It shall be unlawful to load any such floors, or any part thereof, to a greater extent than the load indicated upon such placards. It shall be the duty of occupants of buildings to maintain such placards during their occupation of the premises, and the owners of buildings, or their agents, to cause the same to be properly affixed with each change of occupation. It shall be part of the duty of architects of all buildings to calculate the figures for such placards, which are to be verified and approved by the Commissioner of Buildings before they are affixed upon the respective floors of the different buildings.

Walls.—Ledges.—See Section 588.

Walls.—Around Stairs, Elevators and Shafts. See Section 588.

Walls.—Reinforced concrete. See Section 554.

Towers.—Domes.—Spires.—See Section 613.

ARTICLE V.

PROVISIONS RELATING SOLELY TO CLASS II.

In Class II. shall be included every office building, every hospital and every building used for hotel purposes, or for boarding or lodging house purposes, where such building so used for hotel, hospital or boarding or lodging house purposes is occupied by twenty or more persons.

Sec. 269. (Walls of Class II.)—The thickness of the walls of buildings of Class II. shall conform to the following requirements:

The thickness of the enclosing walls of buildings of this class shall be made in accordance with the following table, to-wit:

| Basement | STORIES | | | | | | | | | | | |
|--------------|---------|----|----|----|----|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Basement and | 12 | 8 | | | | | | | | | | |
| Two-story | 12 | 12 | 8 | | | | | | | | | |
| Three-story | 16 | 12 | 12 | 12 | | | | | | | | |
| Four-story | 20 | 16 | 16 | 12 | 12 | | | | | | | |
| Five-story | 20 | 16 | 16 | 16 | 12 | 12 | | | | | | |
| Six-story | 20 | 20 | 16 | 16 | 12 | 12 | | | | | | |
| Seven-story | 24 | 24 | 20 | 20 | 16 | 16 | 12 | 12 | | | | |
| Eight-story | 24 | 24 | 24 | 20 | 20 | 16 | 16 | 12 | 12 | | | |
| Nine-story | 28 | 24 | 24 | 20 | 20 | 16 | 16 | 12 | 12 | 12 | | |
| Ten-story | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 12 | 12 | |
| Eleven-story | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 12 | 12 |
| Twelve-story | 32 | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 12 |

Provided, however, in buildings of steel skeleton fireproof construction, thickness of walls shall be governed by the provisions of Section 510 of this chapter.

Sec. 270. (**Buildings.—Construction Of.—Height Of.**)—Buildings of Class II. which are one hundred feet or more in height shall be built entirely of fireproof construction.

Buildings of Class II. less than one hundred feet and more than sixty feet in height shall be built entirely of slow-burning, or mill or fireproof construction. Buildings of Class II. not exceeding four stories in height and less than sixty feet in height may be built of ordinary construction.

Sec. 271. (**Walls.—Division and Partitions in Boarding or Lodging Houses and Hotels.**)—In buildings used wholly or in part for boarding houses, lodging houses or hotels, sixty feet or less in height, there shall be for every eight rooms in any one story dividing walls or partitions of incombustible material, separating such eight rooms from the contiguous spaces. Partitions surrounding stairs and corridors shall be made of fireproof material.

Sec. 272. (**Stairs in Buildings of Class II.**)—Stairs in Buildings of Class II. shall be adapted, in number and width, to the area, height and to the uses to be made of the building in which they occur.

For office buildings, by which shall be understood buildings divided into apartments intended for business uses only, and in which there shall be no sleeping apartments whatever, there shall be in buildings of ordinary construction and of less ground area than three thousand square feet, two flights of stairs not less than three feet wide each; for office buildings of ordinary construction and of greater floor area than three thousand square feet, there shall be six inches added to the width of each such flight of stairs for each additional one thousand feet of floor area, or fractional part thereof, up to six thousand square feet of floor area; for office buildings of ordinary construction and of greater floor area than six thousand square feet, there shall be an additional flight of stairs not less than three feet wide for each additional three thousand square feet of floor area, or fractional part thereof.

For office buildings of slow-burning or mill construction there shall be at least two flights of stairs three feet wide each for the first four thousand square feet of floor area, and there shall be six inches added to the width of each such flight of stairs for each additional one thousand square feet of floor area, or fractional part thereof, up to eight thousand square feet of floor area; and an additional flight of stairs not less than three feet wide shall be required for each additional four thousand square feet of floor area, or fractional part thereof, above eight thousand square feet.

For fireproof office buildings there shall be required one flight of stairs not less than four feet in width for the first three thousand square feet of floor area, or fractional part thereof.

For fireproof office buildings of more than three thousand, and not exceeding five thousand square feet of floor area, there shall be required one flight of stairs not less than five feet in width.

For more than five thousand and less than ten thousand square feet of floor area there shall be required an additional flight of stairs not less than three (3) feet in width.

For more than ten thousand and less than twenty thousand square feet of floor area there shall be required two flights of stairs of not less width than five (5) feet each; provided, that for each and every fireproof office building of more than ten thousand square feet floor area there shall be at least two stairway fire escapes, placed as far apart as practicable, on such buildings, in addition to the standpipe and platform fire escape required by this chapter and the statutes of this state.

An additional flight of stairs shall be required for each additional ten thousand square feet of floor area; provided, that for each additional five thousand square feet of floor area such stairway shall be not less than three feet wide.

And for additional floor areas between five thousand and ten thousand square feet such stairway shall be not less than five feet in width. The width of the different stairways need not be the same.

Sec. 273. (Hospitals, Hotels, Boarding or Lodging Houses.—Stairways.—Fire Stops.)—For all buildings of Class II. of ordinary construction used as hotels, boarding or lodging houses, or hospitals, there shall be required for each building at least two flights of stairs, which, for buildings of three thousand square feet or less in floor area, shall be of not less width than three feet each, with an increase of six inches in width for each additional one thousand square feet of floor area, or fractional part thereof, up to a floor area of five thousand square feet; and after that there shall be an additional flight of stairs not less than three feet wide for each additional two thousand feet of floor area, or fractional part thereof.

For all buildings of Class II. of slow-burning or mill construction used as hospitals, hotels, boarding or lodging houses, there shall be required for each building at least two flights of stairs, which, for buildings of four thousand square feet or less in floor area, shall be of not less width than three feet each, with an increase of six inches in width for each additional one thousand square feet of floor area, or fractional part thereof, up to a floor area of six thousand square feet; and after that there shall be an additional flight of stairs not less than three feet wide for each additional three thousand feet of floor area, or fractional part thereof.

For all buildings of Class II. of fireproof construction used as hospitals, hotels, boarding or lodging houses, there shall be required for each building at least two flights of stairs, which, for buildings of five thousand square feet or less in floor area, shall be of not less width than three feet each, with an increase of five inches in width for each additional one thousand square feet of floor area up to a floor area of ten thousand square feet, and there shall be required an additional flight of stairs not less than three feet wide for each additional four thousand square feet of floor area, or fractional part thereof.

Each stairway in the fifth, sixth, seventh and eighth stories may be built six (6) inches less in width in the clear than the stairways in the first to the fourth stories, inclusive.

Each stairway in the ninth, tenth, eleventh and twelfth stories may be built twelve (12) inches less in width in the clear than the stairways in the first to the fourth stories, inclusive.

Each stairway in the thirteenth, fourteenth, fifteenth and sixteenth stories may be built eighteen (18) inches less in width in the clear than the stairways in the first to the fourth stories inclusive, and this reduction in width may be continued in the same ratio in each additional four (4) stories added to the height of the building; provided, however, that no stairways shall have a less clear width than three (3) feet.

All stairways in buildings of Class II. shall have a hand rail on each side thereof, and where there is more than one flight of stairs in any building of Class II., such stairways shall be located at each end of the building, or as far apart from each other as is practicable.

In hotels, hospitals, lodging houses or boarding houses, of other than fireproof construction, there shall be a fire stop of brick, concrete or tile, between the ceiling and floor in each floor of joists for each twenty-five feet, or fractional part thereof, measured in the direction of the length of the joists.

Sec. 274. (Air.—Means of Communication With Outer Air in Buildings of Class II.)—Amended by ordinance of Oct. 22, 1906, to read as follows:

In all buildings of this class, the fire escape, stairs, stair halls, entrance halls, bay windows, vent shafts, courts, lights in halls, porches, windows in public halls, shall be of the size and dimensions as are prescribed in Sections 392, 400, 402, 404, 412, 415, 416, 417, 418, 419, 420, 421, 422, and 423 of this chapter relating to buildings of Class VI.

Where vent shafts as defined in Section 389 of this ordinance, are used to ventilate water closet compartments, bath rooms, or pantries, of hotels, office buildings, or club houses, they shall be of the following dimensions:

| Building | Square feet | Least width |
|-----------|----------------|----------------|
| 2 stories | 22½ | 3 feet |
| 3 stories | 27 | 3 feet |
| 4 stories | 36 | 3 feet |
| 5 stories | 48 | 5 feet |
| 6 stories | 72 | 6 feet |
| 7 stories | 96 | 8 feet |
| 8 stories | 120 | 8 feet |

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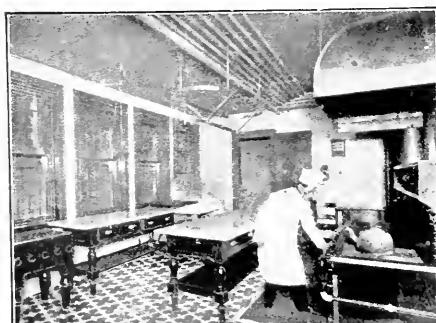
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In every hotel, office building, or club house, hereafter erected, and every hotel, office building, or club house, which shall be increased or diminished in size, or otherwise altered after its erection, and in every building, now or hereafter in existence, not now used as a hotel, office building or club house, but hereafter constructed or altered to such use, and every habitable room, excepting water closet compartments, bathrooms and pantries, shall have at least one window opening directly upon a street, alley, yard, or court. The total area of the windows opening from any such room (other than water closet compartments, bathrooms and pantries), shall be, at least one-tenth the floor area of that room, and the top of, at least, one window shall be not less than seven feet above the floor, and the upper half of that window shall be made so as to open its full width. No window in any such room (other than pantries, water closet compartments and bath rooms), shall have less than ten square feet of glass area. Every such water closet compartment, bathroom or pantry, shall have a window not less than one foot wide and of an area of, at least, four square feet for a floor area of forty-five square feet or less opening directly into the outer air, or special light or air shafts, into which no other rooms, or compartments, other than toilet compartments, bathrooms, or pantries, are ventilated. For upwards of forty-five square feet of floor area there shall be a window area of at least one-tenth of the floor area. The windows in all cases shall be arranged so as to admit of their being opened at least one-half of their height. The urinal, bath or water closet compartments on the top floor of any building may be lighted and ventilated by means of a skylight and ventilator. The area of the skylight shall conform to the above specified areas for windows.

It is provided that in hotels, office buildings and club houses, the bathroom, water closet and urinal compartments, may be ventilated by exhausting the air from the same at the rate of at least six complete changes of air from each room per hour by approved positive mechanical means through special air ducts to the outer air. The special ventilating duct or ducts, together with their branches, shall be of such size or sizes as to provide for the required changes of air from each of such rooms.

It shall be the duty of the owner, agent, architect, or of the party in possession or control of the same to notify the Commissioner of Health in writing twenty-four hours in advance when any such system is completed, for the supervision of the test.

When the installation of the mechanical ventilating system for toilet and bathrooms is complete, and the ventilating appliances are being operated at their normal capacities, they shall be tested by the party notifying for test for volumetric efficiency in the presence of, and under the direction of, the Chief Sanitary Inspector of the Department of Health.

The mechanical ventilating system shall at all times be kept in good repair and in operation to insure the required ventilation during the hours when the above specified buildings are used for human occupancy.

All such toilet or bathrooms as mentioned in this section, shall have a fixed window, or windows, having a gross glass area and equal to at least one-eighth of the floor area of rooms. The windows are to be provided and placed in the dividing or enclosing partitions, and shall be suitably arranged so as to admit of natural light from an adjoining room which has direct communication to the outside air. All such rooms or compartments shall have proper means for artificially lighting the same, and they shall be properly and adequately lighted by natural or artificial means during the occupancy of the building.

Sec. 275. (Joists.—Supports For.)—If in buildings of Class II. the distance between the enclosing walls is more than twenty-four feet in the clear, there shall be intermediate supports for the joists, which supports shall be either brick walls or iron or steel columns and beams or trusses or girders. If brick walls are used for this purpose, they may, in all cases where the thickness of walls is given in the table as sixteen inches or more, be made four inches less in thickness than the dimensions stated in the table.

Sec. 276. (Loads.—Allowance for Live Loads in Construction of Floors of Class II.)—For all buildings of Class II. the floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of the floor construction, partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of fifty pounds for every square foot of surface in such floors.

Sec. 277. (Stalls or Rooms of Class II.—When Considered Habitable.)—In buildings of Class II. no room shall be considered habitable or used as a habitation unless it has at least one window of an area equal to one-tenth of the superficial area of such room, opening into the external air. Provided, however, that no stall or compartment used as a sleeping room in a building, the walls of which stall or compartment do not extend within a distance of two and one-half feet from the ceiling thereof, shall be regarded and considered to be a room within the intent and meaning of the provisions hereof, but the walls of every such stall or compartment shall be of incombustible material.

Sec. 278. (**Hospitals.—Construction.—Height Of.—Permits.—Special Consents.**)—It shall be unlawful for any person or corporation to build, construct, maintain, conduct or manage in any block, if two-thirds of the buildings fronting upon both sides of the streets bounding such block or square are devoted chiefly to residence purposes, any hospital for the care, treatment or nursing of three or more insane persons; or any hospital for the care, treatment or nursing of three or more inebriates, or persons suffering from the effect of the excessive use of alcoholic liquors; or any hospital for the care, treatment or nursing of three or more epileptics; or any hospital for the care, treatment or nursing of three or more persons addicted to, or suffering from, the excessive use of morphine, cocaine or other similar drugs or narcotics; or any hospital for the care, treatment or nursing of any person affected with any infectious or contagious disease, unless the owners of a majority of the frontage in such block or square, and in addition thereto the owners of a majority of the frontage on the opposite sides of the streets bounding such block or square, consent in writing to the building, constructing, maintaining, managing or conducting of any such hospital in such block or square. Such written consents of the majorities of such property owners shall be filed with the Commissioner of Buildings, and an exact copy of same shall be filed with the Commissioner of Health before a permit shall be granted for the building or constructing, or a license issued for the maintaining, conducting or managing of any such hospital. Provided, that any building that may be used for hospital purposes which is over two stories in height shall be of fireproof construction throughout, and no hospital shall be built to exceed six stories in height.

Sec. 279. (**Hospitals.—Location of Near School Houses.**)—No hospital of any kind or description hereafter erected or established shall be erected or established within four hundred feet of property used for school purposes. (Note: This section is repealed by ordinance of June 1, 1908, page 509, governing hospitals, [Sections 1102, etc.])

(**Walls.—Ledges.—Joist Supports.**)—All ledges in walls shall be as specified in Section 588 of this chapter.

Walls.—Reinforced concrete. See Section 554.

Sec. 280. (**Roofs.—Strength Of.**)—The roofs of buildings of Class II. shall be designed and constructed as is required in Section 610.

Roofs.—Shingle.—See Section 609.

Towers, Domes and Spires.—Construction Of.—See Section 613.

Skylights.—Construction, Glass In. See Section 614.

Bay Windows and Light Shafts.—Material for. See Section 600.

Doors and Windows.—When required to be closed.—Fire resisting glass. See Section 632.

Wind Pressure.—Precautions against. See Section 603.

Windows.—Cleaning, safety devices. See Section 726.

Buildings Used for the Purposes of More than One Class.—See Section 249.

Limitations in Changing Class of Buildings.—See Section 633.

Walls.—Around Stairs, Elevators and Shafts.—See Section 588.

ARTICLE VI.

PROVISIONS RELATING SOLELY TO CLASS III.

In Class III. shall be included every building used as a family residence; also every building used for stabling purposes, where such building so used shall occupy a ground area of less than five hundred square feet.

Section 281. (**Walls of Class III.—Thickness of.**)—Buildings of Class III. shall conform to the following requirements:

The thickness of enclosing walls of buildings of this class shall be in accordance with the following table, to wit:

| | Basement. | STORIES | | | | | | | | | | | |
|--------------|-----------|---------|----|----|----|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Basement and | 12 | 8 | | | | | | | | | | | |
| Two-story | 12 | 12 | 8 | | | | | | | | | | |
| Three-story | 16 | 12 | 12 | 12 | | | | | | | | | |
| Four-story | 20 | 16 | 16 | 12 | 12 | | | | | | | | |
| Five-story | 20 | 16 | 16 | 16 | 12 | 12 | | | | | | | |
| Six-story | 20 | 20 | 16 | 16 | 16 | 12 | 12 | | | | | | |
| Seven-story | 24 | 24 | 20 | 20 | 16 | 16 | 12 | 12 | | | | | |
| Eight-story | 24 | 24 | 24 | 20 | 20 | 16 | 16 | 12 | 12 | | | | |
| Nine-story | 28 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 12 | 12 | | | |
| Ten-story | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 12 | 12 | | |
| Eleven-story | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 12 | 12 | |
| Twelve-story | 32 | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 12 | 12 |

Provided, however, in buildings of steel skeleton fireproof construction, thickness of walls shall be governed by the provisions of Section 510 of this chapter.

Sec. 282. (**Buildings.—Construction Of.—Height Of.**)—Buildings of Class III, which are one hundred feet or more in height shall be made entirely of fireproof construction.

Buildings of Class III, less than one hundred feet and more than sixty feet in height shall be built entirely of slow-burning mill or fireproof construction.

Buildings of Class III, less than sixty feet in height may be built of ordinary construction.

Sec. 283. (**Skylights.—Construction Of.—Glass In.**)—The skylight on the roof of any building of Class III, other than a frame building, shall have the sides, sashes and frames constructed of metal, or of wood metal clad on all exterior surfaces. If the building exceed three stories in height, such skylight shall have at least six inches over same a strong wire netting (wire not lighter than No. 8 and mesh not coarser than $1\frac{1}{2} \times 1\frac{1}{2}$ inches), unless the glass contains a wire netting within itself.

Sec. 284. (**Loads.—Allowance for Live Loads in Construction of Floors of Class III.**)—For all buildings of Class III, the floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of forty pounds for every square foot of surface in such floors.

Sec. 285. (**Rooms of Class III.—When Considered Habitable.**)—In buildings of Class III, no room shall be considered habitable or used as a habitation unless it has at least one window of an area equal to one-tenth of the superficial area of such room opening into the external air.

Sec. 286. (**Fire Walls.—Thickness Of.—When Dispensed With.**)—In buildings of Class III, fire walls of brick not less than twelve inches thick shall be built, extending above the roof thereof, if such roof is flat, and also above the roof of such building where the same abuts against another building, or where the same stands upon any line of any lot, excepting street or alley lines. Provided, that where eight-inch walls are permitted in the top story of buildings, or where the building is not over three stories high, the fire walls may be eight inches thick. Such fire walls, where they stand upon lot lines or where they are over the dividing walls between buildings, or over the dividing walls in the interiors of buildings, where such are required by the provisions of this chapter by reason of the great area of such buildings, shall extend at least two feet above the roof of such buildings. Fire walls upon street and alley lines shall extend not less than eighteen inches above the roofs of such buildings. Fire walls may be dispensed with on street and alley lines, if the tops of the roof boards and roof joists are protected against fire for a distance of at least five feet from such street or alley lines by a coating of mortar or hollow tile or porous tile at least two inches thick. Fire walls at street and alley lines may also be dispensed with in all cases where the entire framing and material of the roof is made strictly fireproof.

Walls facing upon courts and light shafts shall be treated as in the same category with walls facing upon streets and alleys.

Fire walls shall be covered with a weatherproof coping of incombustible material.

Sec. 287. (**Bay Windows and Light Shafts.—Material For.**)—Bay or oriel windows and light shafts may be built of combustible material in buildings of Class III, of two stories or less in height, provided, such bay and oriel windows or light shafts shall not have a greater width than twelve feet at wall line of building, and, provided, that the outside walls, roofs and soffits of such bay or oriel windows and light shafts, when so constructed, shall be covered with sheet metal or other incombustible material. In all other cases, bay and oriel windows and light shafts and their supports shall be constructed entirely of incombustible material.

Sec. 288. (**Walls.—Brick Wall Upon Wooden Sills.—Level of Sills Allowed.**)—All buildings of Class III, not exceeding one story in height and twenty feet in height from top of sills to highest point of roof, and with side walls not exceeding fourteen feet in height, and with floor area not exceeding one thousand two hundred square feet, may have brick walls not less than eight inches in thickness erected on wooden sills, the sills supported on iron, masonry or concrete supports extending four feet below the surface of the ground. The foundations under such supports shall be of concrete, stone or brick, each covering not less than five square feet area and not more than eight feet apart to support the weight that may rest upon them with safety; sills shall be placed not higher than four feet above the established grade of the street upon which the lot fronts, and upon which lot the building is erected, where grades are established, and not exceeding seven feet above the ground where grades are not established. In all cases of buildings being more than one story and

less than two stories high, and having a gable or hip roof of not less than one-third (1-3) pitch, 8-inch walls on solid brick or stone masonry may be used, provided they do not exceed 14 feet in height measured from the first floor joist, and provided such buildings have a floor area not exceeding one thousand two hundred (1,200) feet, and are not over twenty-two feet in width.

Roofs.—Strength Of. See Section 610.

Roofs.—Shingle and Gravel. See Section 609.

Wind Pressure. Precautions against. See Section 603.

Walls.—Reinforced Concrete. See Section 554.

Walls.—Ledges. See Section 588.

Towers, Domes and Spires. See Section 613.

Limitations in Changing Class of Buildings. See Section 633.

ARTICLE VII.

PROVISIONS RELATING SOLELY TO CLASS IV.

In Class IV. shall be included every building used as an assembly hall, whether such hall is used for the purpose of worship, instruction or entertainment, unless such building is used for any of the purposes for which buildings of Class V. or Class VIII. are used.

Sec. 289. (Walls.—Outside Walls of Class IV.—Structures Built Above.—Walls Of.)—The outside walls of every building used wholly or in part for the purposes of Class IV., the roof or ceiling of which is carried on trusses or girders of a span of fifty feet or more, shall be as follows:

If such walls are less than twenty-five feet high, not less than twenty inches thick.

If they are more than twenty-five feet high and less than forty-five feet high, they shall not be less than twenty-four inches thick.

If they are more than forty-five feet and less than sixty feet high, they shall not be less than twenty-eight inches thick.

If they are more than sixty feet and less than seventy-five feet high, they shall not be less than thirty-two inches thick.

If they are more than seventy-five feet and less than ninety feet high, they shall not be less than thirty-six inches thick.

An increase of four inches in thickness of such walls shall be made in all cases where they are over one hundred feet long without cross walls of equal height.

Walls around stairs, elevators and shafts. See section 588.

For rooms used for the purposes of Class IV., where such rooms are less than fifty feet wide in the clear, the thickness of the walls enclosing or surrounding such rooms may be reduced by four inches.

The outside walls of every building of Class IV., the roof or ceiling of which is not carried on trusses or girders, shall be of the same thickness as in buildings of Class I.

If one or more stories are built above the room or rooms, or portion of any such building devoted to the uses of Class IV., and such stories are carried on trusses or girders, the thickness of walls shall be increased by four inches for each two stories or part thereof above every such room.

If solid masonry buttresses are employed, and placed eighteen feet or less apart, and extended to the foot of the trusses or girders carrying the ceiling, or if iron or steel pillars are inserted in such walls for the support of the superstructure, and at distances not more than twenty-four feet between centers, and if such pillars extend to and carry the superimposed trusses and girders, the thickness of such walls may be reduced in proportion to the increase of strength afforded by such buttresses or pillars; but in no case shall any such wall be less than twelve inches thick in the top story; four inches shall be added, going downward, for each story, or for each twenty-five feet in height of wall. Provided, that if in any building of this class now in existence the structural parts thereof do not comply with the foregoing requirements, and structural changes are made therein, then all walls, columns or other structural parts shall be strengthened in a manner satisfactory to the Commissioner of Buildings.

Sec. 290. (Walls.—Columns In.)—If iron or steel columns are introduced in such walls, the brickwork around the same shall be bonded into that of the connecting walls, and each of such columns shall be fireproofed, as provided in Section 511 of this chapter.

Sec. 291. (Frontage of Class IV. Seating Less Than 800.)—Buildings of Class IV., containing halls or rooms of an aggregate seating capacity of eight hundred persons or less, shall have for each hall or room a frontage upon two public spaces, of which at least one shall be a street, and of which the other, if it is not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street.

Sec. 292. (Frontage of Class IV.—Seating Over 800.)—Buildings of Class IV., containing halls or rooms used for the purposes of Class IV. of greater aggregate seating capacity than eight hundred, shall have for each such hall or room a frontage upon three open spaces, of which at least one shall be a public street, while the two others, if not streets, shall be public or private alleys of a width of not less than ten feet each, opening directly on a public street, or fireproof passageways or tunnels of not less than seven feet each in width may be used in place of these alleys, provided, such passageways or tunnels lead to a public thoroughfare.

Sec. 293. (Buildings, Class IV.—Construction Of.)—Amended Dec. 11, 1905, to read as follows:

Buildings of Class IV., containing halls of an aggregate seating capacity of not more than eight hundred, may be built of ordinary construction. If such halls have a greater aggregate seating capacity than eight hundred (800) and less than one thousand five hundred (1,500), such building shall be built of mill, slow-burning, or fireproof construction. If such hall have an aggregate seating capacity of one thousand five hundred (1,500) or more, such buildings shall be built entirely of fireproof construction, provided that buildings mainly used for exposition or exhibition purposes, and not exceeding two stories in height, or having for public use only a main floor and one gallery, and which have their outside walls and structural members of incombustible material and which comply in all other respects with this ordinance, may have their temporary seats, boxes, showcases, platforms, or booths, constructed of combustible material.

In computing the seating capacity of any room or building used for the purposes of Class IV., in which the seats are not fixed, an allowance of eight square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation. *Provided, that in church buildings not having more than two stories and each floor having its own separate exits and standing free from all buildings, the seating capacity of each floor shall be estimated alone as determining the kind of construction under this article.*

Distance of said building from any other structure or building, to be at least seven feet on all sides.

As amended February 4, 1907.

Sec. 294. (Buildings of Class IV., Used Partly for Other Purposes.)—Any building occupied wholly or in part for the purposes of Class IV., shall be built entirely of fireproof construction, if the halls or rooms used for the purposes of Class IV. therein have an aggregate seating capacity greater than one thousand five hundred.

Sec. 295. (Buildings of Certain Height.—Construction Of.)—Any building higher than sixty feet and connected with or made part of any building used wholly or in part for the purposes of Class IV., shall be entirely of fireproof construction. Any such building less than sixty feet in height shall, if its case is not already covered by other provisions of this chapter, be made of fireproof, slow-burning or mill construction.

Sec. 296. (Opening Between Non-Fireproof Buildings.)—In all cases where fireproof construction is not used for the whole of two or more connected buildings, used wholly or in part for the purposes of Class IV., there shall be at each connecting opening double iron doors.

Sec. 297. (Spires, Cupolas and Domes Upon Houses of Worship.—Violation.—Spires, Cupolas, etc., to be Taken Down.—Roofs of Isolated Buildings of Class IV.)—Spires, cupolas or domes with a framework of non-fireproof material and covered on the outside with incombustible material, may be erected as part of any house of public worship, and if such house of worship is so built that it is nowhere nearer than twenty feet to any line of the lot upon which it stands (street and alley lines excepted), such non-fireproof spires, cupolas or domes may be maintained only while this intervening space of twenty feet is maintained unoccupied as part of the grounds or premises belonging to such house of public worship. If the conditions of such building be so changed that there shall not be a vacant space as hereinbefore required surrounding same, such spire, cupola or dome shall be forthwith taken down.

The roofs of isolated buildings, occupied for purposes of Class IV., shall be constructed in the same manner as that provided for spires, domes and cupolas.

Provided, however, that the roofs of houses of worship outside the fire limits not exceeding twenty-eight hundred square feet in area may be covered with shingles.

Sec. 298. (Floor Levels.—Limitation of Floor Levels of Class IV.—Auditorium Floor of Class IV.—Height Above Sidewalk.—Stairs.)—The following limitations of floor levels in buildings occupied either wholly or in part for purposes of Class IV. shall be observed in all cases.

In buildings occupied either wholly or in part for purposes of Class IV., no auditorium of a greater seating capacity than one thousand shall have the highest part of its main floor at a greater distance than ten feet above the adjacent sidewalk.

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grades. No room or rooms used for the purposes of Class IV., of greater seating capacity than five hundred, shall be at a greater distance above the sidewalk grade than thirty feet. No room or rooms used for the purpose of Class IV., of greater seating capacity than two hundred, shall be at a higher level above the sidewalk grade than forty-five feet.

Provided, however, that in the case of a building used either wholly or in part for the purposes of Class IV., and built wholly of fireproof construction, a room or rooms to be used for the purposes of Class IV., and of an aggregate seating capacity of less than five hundred, may be located in any story thereof, but in such case there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located to the ground, each of which stairs shall be not less than four feet wide in the clear.

Sec. 299. (Loads, Allowance for Live Loads in Construction of Floors of Class IV.—Stairways.—Entrances and Exits, Width Of.)—All floors of all buildings of Class IV. shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floor. The width of stairways in buildings used wholly or in part for the purposes of Class IV. shall be eighteen inches for every one hundred of the aggregate seating capacity of all rooms in such building, which are used for the purposes of Class IV., and for fractional parts of each one hundred seating capacity a proportionate part of eighteen inches shall be added to the width of such stairways, but no stairway in such building shall be less than four feet wide in the clear, except as hereinafter provided; and provided, further, that in any such building having a room or rooms used for purposes of Class IV., the aggregate seating capacity of which shall not exceed two hundred and fifty persons, two separate and distinct three-foot stairways shall be permitted.

All stairways shall have hand railings on each side thereof. Stairways which are over 7 feet wide shall have double intermediate handrails, with end newel posts at least 5½ feet high. No stairways shall ascend a greater height than thirteen feet six inches without a level landing, which, if its width is in the direction of the run of the stairs, shall not be less than three feet wide, or which, if at a turn of the stairs, shall not be of less width than the width of the stairs.

Stairways leading to a box or boxes, seating not to exceed thirty people in the aggregate, shall be independent of all other stairs or seats and not less than two feet six inches wide in the clear. For each additional twenty-five of seating capacity, or major portion thereof, in such boxes, an additional width of five inches shall be added to such stairways.

(Walls.—Ledges.)—See Section 588.

(Doors and Windows.—When Required to Be Closed.—Fire-Resisting Glass.)—See Section 632.

Sec. 300. (Balconies and Galleries.—Exit and Entrance.)—Distinct and separate places of exit and entrance shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the balcony, provided its capacity be equal to the aggregate capacity of all aisles or corridors leading from the main floor and such balcony to such place of exit and entrance.

Sec. 301. (Balconies and Galleries.—Designation Of.)—Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony," and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery." Such designation shall be plainly printed on all admission tickets.

Sec. 302. (Aisles.—Steps in Aisles.—Passageways.—Kept Unobstructed.—Width of Corridors, Passages, Hallways and Doors.)—Aisles in rooms or auditoriums used for the purposes of Class IV. shall in the aggregate be eighteen inches in width for each one hundred of the seating capacity of such room or auditorium, and for fractional parts of one hundred, a proportionate part of eighteen inches shall be added; but no aisle shall be less than two feet and six inches in width in its narrowest part.

Steps shall be permitted in aisles only as extending from bank to bank of seats, and whenever the rise from bank to bank of seats is less than five inches the floor of the aisles shall be made as an inclined plane, and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors. All aisles and passageway in such rooms or auditoriums shall be kept free from camp stools, sofas, chairs and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles or passageways during any performance, service, exhibition, lecture, concert, ball, or any public assembly.

Sec. 303. (**Corridors, Passageways, Hallways and Doors.—Width of.**)—The Width of corridors, passageways, hallways and doors adjacent to, connected with or a part of such rooms or auditoriums, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be anywhere less than four feet in width, and no such door shall be less than three feet in width.

Sec. 304. (**Seats.—Number of in Rows.**)—There shall not be more than fourteen seats in any one row between aisles.

Rows of seats shall not be less than 2 feet 8 inches from back to back, and no bank of seats shall be of greater rise than 24 inches.

Sec. 305. (**Emergency Exits.**)—Emergency exits and stairways shall be provided outside of the walls of all assembly halls of a larger seating capacity than eight hundred. Provided, however, that if any such assembly hall is used for any of the purposes described in Section 311 of this chapter, and has a seating capacity of more than four hundred, such assembly hall shall have emergency exits to the street of one-half the aggregate width of the main exits, but no such emergency exit shall be less than three feet in width.

Such emergency exits and stairways therefrom may be built inside the walls of the building in a corridor or passageway not less than seven feet wide, which corridor or passageway shall be surrounded by a fireproof partition, not less than four inches thick.

Such stairways shall be made of wrought iron or steel, or other approved fireproof material and cast iron is not approved for this work. All emergency exits and stairways therefrom shall be kept free from obstruction of any kind, including snow and ice.

Sec. 306. (**Doors to Open Outward.**)—All doors affording access directly or indirectly to the street from any room used for the purposes of Class IV. shall open outward upon suitable hinges.

Exit doors from such rooms shall not be obscured by draperies and shall not be locked, or fastened, in any manner during the entire time any such room is open to the public, but shall be so constructed and maintained that they may be easily opened from the interior.

Sec. 307. (**Walls Between Auditorium and Stage.**)—In buildings used either wholly or in part for the purposes of Class IV. hereafter erected, there shall be a solid brick wall, of the same thickness as that called for on the outside walls, between the auditorium and stage; and in non-fireproof buildings such walls shall extend to a height of three feet above the roof. Provided, however, that in existing buildings, any room used for the purposes of Class IV., and having a seating capacity greater than four hundred, shall have the proscenium wall built of incombustible material.

Sec. 308. (**Curtain Shall Be Iron, Steel or Asbestos.—Inspection Of.—Fee.**)—The main curtain opening in any such room shall have a wrought iron or steel or asbestos curtain, which shall be inspected by the building department semi-annually, for which inspection a charge of two dollars shall be made, and all other openings in the proscenium wall shall have self-closing iron doors.

Sec. 309. (**Structures Over Ceiling.—Construction.**)—If any structure is built over the ceiling or roof of any building used either wholly or in part for the purposes of Class IV., the different members of the girders or trusses supporting same shall have their fireproofing double, in the manner required for columns for fireproof buildings of Class I.

Sec. 310. (**Fire Apparatus on Stage.**)—In all rooms used for the purpose of Class IV. of a seating capacity of two hundred and fifty or more, where stationary scenery is used, there shall be kept for use two or more portable fire extinguishers or hand fire pumps on and under the stage, and also four fire department axes, two fifteen-foot hooks and two ten-foot hooks on each tier or floor of the stage, subject to the approval of the Fire Marshal, and in such rooms of less seating capacity than two hundred and fifty, there shall be at least one portable fire extinguisher.

Sec. 311. (**Rooms Used for Regular Theatrical or Vaudeville Performances.—Exit Doors.—Fireman.—Employment of.—Duties.**)—Amended by ordinance June 8, 1908, to read as follows:

Exit doors shall not be obscured by draperies and shall not be locked or fastened in any manner during the entire time any such room of Class IV. is open to the public, so as to prevent them from being easily opened outwardly; and such doors shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

It shall be the duty of every person, firm or corporation conducting, operating or maintaining any room having a seating capacity of three hundred or more, used for the purposes of Class IV. and which is used regularly for theatrical or vaudeville performances,

and where an admission fee is charged, to procure at his, their or its own expense the attendance at each and every performance of one fireman who shall be detailed by the Fire Marshal from the regular City Fire Department; he shall be in the uniform of the Chicago Fire Department and he shall be on duty at such place wherein such theatrical or vaudeville performance is given during the entire time it is open to the public. He shall report to and be subject to the orders of the Fire Marshal and shall see that all fire apparatus required by this Chapter is in its proper condition, ready for use, and that all exit doors are unlocked during the entire time such building is open to the public, and are all in efficient and ready working order.

Such fireman and the Fire Marshal shall require all persons employed in or about such room to be drilled in the use of all apparatus and appliances for the prevention of fire installed therein, at least twice in every week, and such fireman shall report to the Fire Marshal the manner and efficiency of such drill. Such fireman shall report in writing daily to the Fire Marshal the condition and equipment of the building, or portion thereof, to which he is detailed. No fireman shall be on duty at any one building for a longer period than two weeks.

The compensation to be paid to the city for the services of such city fireman so detailed shall be based on the regular salary paid by the city to such fireman and shall be computed according to the ratio between the number of hours such fireman is required by his duties hereunder to devote to such theater and the total number of hours such fireman is employed by the city for all purposes. All sums received by the city under the provisions of this section shall be for the use and benefit of the Fire Department.

Sec. 312. (Standpipe and Hose on Stage.)—A standpipe not less than one and one-half inches in diameter, with a hose connection and hose valve therein, shall be installed on each side of the stage in such room, and shall at all times have a hose connected thereto, ready for use.

Such standpipe shall be connected with a power pump or gravity tank so that a sufficient pressure of water shall be furnished through such standpipe to afford adequate fire protection. The pressure to be furnished by such tank or pump shall be satisfactory to the Fire Marshal.

Sec. 313. (Vents or Flue Pipes.)—One or more vents or flue pipes of metal construction or other incombustible material approved by the commissioner of buildings shall be built over the stage, and shall extend not less than ten feet above the highest point of the roof, and shall be equivalent in area to one-twentieth of the area of the stage.

In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls, and shall be continued and run up on the exterior of the building to a point five feet above the highest point of the additional stories.

All such flues or vents shall be provided with metal dampers, and shall be opened by a closed circuit battery, approved by the City Electrician.

Such dampers shall be controlled by two switches, one at the Electrician's station on the stage, which station shall be fireproof, and the other at the city fireman's station on the opposite side of the stage; such switches shall be located in such places on the stage as may be designated by the Fire Marshal, and each switch shall have a sign with plain directions as to the operation of same printed thereon.

Sec. 314. (Fuse Boxes.)—All fuse boxes shall be surrounded by two thicknesses of fireproof material, with an air space between, and no fuse shall be exposed to the air between the switchboards; all electrical equipment in such rooms shall be installed and maintained to the satisfaction and approval of the City Electrician.

Sec. 315. (License.)—The amusement license for each room used for the purposes of Class IV. shall state the number of persons such room has accommodations for, which number shall be governed by the provisions of this chapter relating thereto, and no more than that number shall be allowed to be in such room at any one time.

No amusement license shall be issued for any room used for the purposes of Class IV. unless the Commissioner of Buildings, the Fire Marshal and the City Electrician shall first have certified, in writing, that such room complies with the provisions of this chapter in every respect.

Sec. 316. (Exits.—Diagram of, Printed on Programs.—Signs Over.)—It shall be the duty of the owner, lessee, or manager of every room used for the purposes of Class IV., and in which programs are issued for performances given therein, to cause to be printed on such programs a diagram showing conspicuously the exits from such room. The word "Exit" shall be in letters at least six inches high over the opening to every means of egress from any such room, and in any such room having a greater seating capacity than four hundred, a red light furnished by gas or sperm

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oil shall be kept burning over such word during the entire period such room is open to the public and until the audience has left such room.

Sec. 317. (All Parts of Room Well Lighted During Performance.)—Every portion of any room used for the purposes of Class IV. and all outlets therefrom leading to the streets, including the passageways, courts and corridors, stairways, exits and emergency exit stairways, shall be well and properly lighted during every performance, and the same shall be kept so lighted until the entire audience has left the premises; and every passageway, or court, or corridor, or stairway, or exit, or emergency exit stairway, shall be provided with signs, indicating the way out of the building, the letters of which shall not be less than six inches in height.

Sec. 318. (Lights in Halls, Corridors and Lobbies, Control of.—Separate Shut-Off.—Connection with Gas Mains.—Protection of Suspended and Bracket Lights.—Protection of Lights Inserted in Walls.—Protection of Foot Lights.—Construction of Border Lights.—Ducts and Shafts Conducting Heated Air from Lights.—Protection of Stage Lights.)—All gas or electric lights in the halls, passageways, corridors, lobby or other means of ingress to or egress from any such room shall be controlled by a separate shut-off, located in the lobby, and controlled only in that particular place. Gas mains supplying any such room shall have independent connections for the auditorium and stage, and provision shall be made for shutting off the gas from the outside of the building. All suspended or bracket lights surrounded by glass, in the auditorium, or in any part of any such room, shall be provided with proper wire netting underneath. No gas or electric light shall be inserted in the walls, woodwork, ceilings, or in any part of any such room, unless protected by fireproof materials. The footlights, if gas light, in addition to the wire network, shall be protected by a strong wire guard, not less than two feet distant from such footlights, and the trough containing such footlights shall be formed of, and be surrounded by, fireproof materials. All border lights shall be constructed according to the best known methods, subject to the approval of the City Electrician, and shall be suspended by wire rope. All ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal, and made double, with an air space between. All stage lights, if gas, shall have strong metal wire guards or screens, not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of the flame, and such guards or screens shall be firmly soldered to the fixtures in all cases.

The use of calcium lights in any hall or room used regularly for theatrical or vaudeville performances is prohibited, and no calcium lights shall be permitted upon any stage; all arc lights used on the stage shall be subject to the approval of the City Electrician.

318a. It is hereby made the duty of all owners, occupants or lessees of theaters or places of amusement to provide separate dressing room or rooms for males and females in all theaters and places of amusement where dressing room or rooms are provided underneath, adjacent to or above the stage, or elsewhere in the building wherein said theater or place of amusement is located or maintained. The partitions forming said dressing room or rooms, except where already built, shall be constructed with incombustible material.

It shall be unlawful for any person, firm or corporation, whether owner, occupant or lessee of any theater or place of amusement, to permit the joint use by both males and females of any dressing room either underneath, adjacent to or above the stage, or elsewhere in the building wherein any theater or place of amusement is located or maintained.

Passed March 22, 1909.

Sec. 319. (Apparatus Under Control of Fire Marshal.)—The standpipes, hose, and all apparatus for the extinguishing of fire or guarding against the same, required by the provisions of this Chapter to be provided, shall be at all times so provided and kept in a manner satisfactory to the Fire Marshal.

Sec. 320. (Scenery to Be Incombustible.)—No scenery or stage paraphernalia of any sort shall be used upon the stage of any room used for the purposes of class IV., unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

Two sets of such scenery may be used in existing buildings of this class having a seating capacity of less than 800, and the main floor of which is not more than three (3) feet above the street level of the street upon which such building opens.

Two sets of such scenery may also be allowed in existing buildings of this class having a seating capacity of over 800 and not over 1,200, and the main floor of which is not more than three feet above the street level of the street upon which such building opens; pro-

vided, that the main curtain opening in any such room shall have a wrought iron or steel curtain which shall be inspected by the Building Department semi-annually, for which inspection a charge of two dollars shall be made.

As amended by ordinance Feb. 10, 1903.

Sec. 321. (Commissioner of Buildings, City Electrician, Fire Marshal and Superintendent of Police Empowered to Enter.)—The Commissioner of Buildings, City Electrician, Fire Marshal, Superintendent of Police, and their respective assistants, shall have the right to enter any building used wholly or in part for the purposes of Class IV. and any and all parts thereof, at any reasonable time, and at any time when occupied by the public, in order to examine such building, and it shall be unlawful for any person to interfere with them in the performance of their duties.

Sec. 322. (Power of Officers to Close.)—The Commissioner of Buildings, Fire Marshal, City Electrician or Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Class IV. closed, where it is discovered that there is any violation of any of the provisions of this article, until the same are complied with.

Sec. 323. (License.—Mayor Shall Revoke.)—Upon the report to the Mayor by the Commissioner of Buildings, Fire Marshal, City Electrician, or Superintendent of Police, or any of them, that any order or requirement of this article in regard to buildings used wholly or in part for the purposes of Class IV. has been violated or is not being complied with, in any such building, the Mayor shall revoke the amusement license of any amusement or entertainment therein conducted, and shall cause such building, or portion thereof, devoted to the uses of Class IV., to be closed.

ARTICLE VIII.

PROVISIONS RELATING SOLELY TO CLASS V.

Buildings of Class V. Now in Existence.

In Class V. shall be included every building which is used as a public theatre where an admission fee is charged and in which movable scenery is used; provided, however, that public halls and club halls, with a seating capacity of less than six hundred, although occasionally used for theatrical representations, shall not be construed to be public theatres within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stage thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V. as herein defined. Such public halls and club halls shall be included in Class IV., as defined in Section 400 of this ordinance.

Sec. 324. The following provisions shall apply to buildings now in existence and used wholly or in part for the purposes of Class V.

Sec. 325. (Walls.—Outside.—Structures Built Above.)—The outside walls of all such buildings, the roofs or ceilings of which are carried on trusses or girders of a span of fifty feet or more, shall be as follows:

If such walls are less than twenty-five feet high, they shall be not less than twenty inches thick.

If they are more than twenty-five feet and less than forty-five feet high, they shall be not less than twenty-four inches thick.

If they are more than forty-five feet and less than sixty feet high, they shall be not less than twenty-eight inches thick.

If they are more than sixty feet and less than seventy-five feet high, they shall be not less than thirty-two inches thick.

If they are more than seventy-five feet and less than ninety feet high, they shall be not less than thirty-six inches thick.

An increase of four inches in thickness of such walls shall be made in all cases where they are over one hundred feet long, without cross-walls of equal height.

The thickness of the walls enclosing or surrounding rooms used for the purposes of Class V., where such rooms are less than fifty feet wide, may be reduced by four inches.

If one or more stories are built above any room devoted to the uses of Class V., and such stories are carried on trusses or girders, the thickness of walls shall be increased by four inches for each two stories or part thereof above such room.

If solid masonry buttresses are employed and placed eighteen feet or less apart, and extended to the foot of the trusses or girders carrying the ceiling, or if iron or steel columns are inserted in such walls for the support of the superstructure, and at a distance not more than twenty-four feet between centers, and if such columns extend to and carry the superimposed trusses and girders, the thickness of such walls may be reduced in proportion to the increase of strength afforded by such buttresses or columns, but in no case shall any such wall be less than twelve inches thick in

the top story, and four inches shall be added, going downward, for each story, for each gallery, or for each twenty-five feet in height of wall. Provided, that if in any such building now in existence the structural parts thereof do not comply with the foregoing requirements and structural changes are made therein, then all walls, columns or other structural parts shall be strengthened in a manner satisfactory to the Commissioner of Buildings.

Sec. 326. (*Columns in Walls.—Alterations.*)—Amended by ordinance Dec. 2, 1907, to read as follows:

If iron or steel columns are introduced in such walls, the brick work around the same shall be bonded into that of the connecting walls, and each of such columns shall be fire-proofed, as provided in Section 511 of this Chapter. All alterations in such existing buildings intended to make them comply with the requirements of this chapter may be executed with the same kind of materials as those originally used in the construction of such buildings; provided, that after the said building is brought into compliance with the provisions of this chapter, then, all subsequent alterations, enlargements, repairs, replaced or strengthened structural parts damaged by fire, wear and tear, or otherwise, shall be made of fire-proof construction, iron or steel construction, covered with fireproof materials, as provided by Article XII of this chapter.

Sec. 327. (*Other Classes Built in Conjunction with Class V.—Doors for Openings Between Connecting Buildings.*)—In all cases where existing buildings used wholly or in part for the purposes of Class V. are built in conjunction with or as part of buildings devoted to the uses of other classes, and where such buildings of the other classes, as specified in this chapter, are not built entirely of fireproof construction, double iron doors shall be placed at each connecting opening between such buildings of Class V., and the building connected therewith.

Sec. 328. (*Floor Levels.—Limitations of.*)—The audience room or rooms or auditorium or auditoriums used for the purposes of Class V., containing in the aggregate not more than five hundred seats, if in a fireproof building, may be located in any story thereof, but in such case there shall be at least two separate stairways from the floor or floors in which such audience room or auditorium is located to the ground, each of which stairways shall be not less than four feet in width in the clear.

In existing buildings of fireproof construction, having an audience room or an auditorium with a seating capacity of more than five hundred and less than fifteen hundred, the lowest bank of seats of the main floor thereof shall be not more than twelve feet above the street level, and every such building shall in all other respects conform to the requirements of this chapter. The main floor of no existing theatre of any construction other than fireproof shall be raised above its present elevation.

Sec. 329. (*Loads.—Allowance for Live Loads in Construction of Floors of Class V.*)—For all buildings of Class V., all floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

Sec. 330. (*Stairways.—Entrance and Exits.*)—Stairways affording ingress to or egress from any room or rooms used for the purposes of Class V. shall be in width equivalent to twenty inches for every one hundred of seating capacity of such room and for fractional parts of one hundred a proportionate part of twenty inches of width shall be added, but in no event shall any such stairway be less than four feet wide in the clear, except as hereinafter provided in this section.

All such stairways shall have hand railings on each side thereof and shall not ascend a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall not be less than the width of the stairs; no run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over 7 feet wide shall have double intermediate handrails, with end newel posts at least 5½ feet high.

Steps shall not have a greater rise than seven and three-eighths inches, treads shall not be narrower than eleven inches, and winders shall not be used on any staircase, except where circular staircases are expressly permitted.

In existing theaters each and every balcony and gallery shall have separate and distinct entrance stairways from the sidewalk level, except that in cases where the vestibule or entrance to any such theater is not more than fifteen inches, or two steps, above the sidewalk level and such steps are at or near the building line, the stairways to such balcony and gallery may ascend from the floor of such vestibule or entrance, but if the run of the stairs at the bottom is not toward the street, there shall be a hand rail or rails three feet above the floor constructed from the foot of such stairways for a distance of not less than five feet leading toward the street. All doors intervening between such stairways and the street shall, during each and every performance, be kept unfastened.

There shall be an iron stairway or stairways from the stage to the fly galleries and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairways may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

Stairs leading to a box or boxes seating not to exceed thirty people, in the aggregate, shall be independent of all other stairs and seats and not less than two feet eight inches wide in the clear. For each additional twenty-five of seating capacity, or major portion thereof, there shall be an additional width of five inches added to such stairways.

All stairways on the stage side of the proscenium wall shall be not less than two feet six inches wide.

Instead of increasing the width required for entrances, aisles, exits and stairways to that required by this chapter, the owner, lessee or manager of any such theater shall have the privilege of reducing the number of permanent seats therein until the same ratio between such width and number of seats as hereinbefore provided for shall be established, and if such privilege be taken advantage of, it shall be the duty of the Commissioner of Buildings to make inspection and certify that such ratio actually exists before a license for the operation of any such theater shall be issued.

Sec. 331. (Floors at Exits.)—Floors at all exits shall be so designed as to be level and flush with adjacent floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

Sec. 332. (Seats in Rows Between Aisles.)—More than ten seats in any row between aisles in any gallery shall not be permitted. On the main floor and balcony, not more than eleven seats between aisles shall be permitted; provided, however, that in banks of seats on main floors and balconies that are not at a greater distance than twenty feet from an exit, thirteen seats shall be permitted between aisles.

Seats shall be not less than twenty inches in width, measured at the top of the seat backs.

Rows of seats shall be not less than two feet eight inches from back to back. No bank of seats shall be of greater rise than twenty-two inches.

All groups of seats shall be so arranged that there shall be an aisle at each side of each group, provided, however, that groups of five seats or less may abut upon a tunnel at one side and an aisle at the other side.

The number of banks of seats on the main floor shall not exceed fifteen, unless an intervening or cross aisle is provided between each fifteen banks of seats or a direct exit is provided for each aisle.

The number of banks of seats in the balcony shall not exceed nine unless an intervening or cross aisle is provided between each nine banks of seats or a direct exit is provided for each aisle.

Sec. 333. (Tunnels.—Cross Aisles.—Vertical Rise.—Foyer.)—There shall be no more than twelve feet rise, measured vertically, in any aisle in any gallery without a direct exit by tunnel or otherwise to a corridor with free opening on to the gallery stairs or other direct discharge to the street, or at such elevation of twelve feet an intervening or cross aisle leading directly to an exit. No tunnel shall be less than three feet wide in the clear. No foyer shall be open to the theatre proper except through the exits.

Sec. 334. (Main Floor.—Balcony and Gallery.—Designation of.)—The lower floor of all theaters shall be designated the "Main Floor."

Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony" and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery." Such designation shall be printed plainly on all admission tickets.

Sec. 335. (Aisles, Corridors and Passageways.—Kept Unobstructed.—Steps in Aisles.)—The minimum width of aisles with diverging sides in any room or auditorium used for the purposes of Class V. shall be two feet eight inches at the end near the stage and not less than three feet at the other end.

The minimum width of aisles with parallel sides shall be three feet.

Every aisle shall lead as nearly as possible directly to an exit, but in no case shall the center line of such exit be more than three feet from the center line of any such aisle leading thereto. Steps shall not be permitted in aisles except as extending from bank to bank of seats and no riser shall be greater than seven and three-eighths inches, and no tread shall be less than nine and one-half inches, and whenever the rise from bank to bank of seats is less than five inches, the floor of the aisles shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be isolated, but shall be grouped together and a light shall be maintained so that every place where there are steps in inclosing aisles or corridors shall be clearly lighted. All aisles, passageways, corridors and exits shall be

kept free from camp stools, chairs, sofas and other obstructions, and no person shall be allowed to stand in or occupy any such aisles, passageways, corridors or exits during any performance, service, exhibition, lecture, concert or any public assemblage.

Sec. 336. (**Corridors, Passageways, Hallways and Doors.—Width Of.**)—The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting, however, that no corridor shall be anywhere less than four feet in width, and no door less than three feet wide, except as otherwise herein provided.

All corridors, passageways, hallways and stairways leading from any balcony or gallery to any toilet room, retiring room, smoking room, check room or private office, shall permit of free passage, without returning to an outer exit of the building. Such corridors, passageways, hallways and stairways shall be at least three feet in width in every part between such balcony or gallery and such outer exit, and shall be unobstructed in every part except by doors, not less than three feet in width in the clear, which shall swing outward and which shall not be provided with locks or catches of any kind whatever.

Sec. 337. (**Doors.—Entrance.**)—The entrance doors to every theater shall be of sufficient width to accommodate the entire audience, computed on the basis of twenty inches in width in the clear to each hundred permanent seats, and in addition thereto a proportionate part of twenty inches for a fractional part of each one hundred seats in the audience room or auditorium.

No mirrors shall be so arranged as to give the appearance of a doorway, exit, hallway or corridor, when no such doorway, exit, hallway or corridor is really in existence, nor shall there be any false doors or windows giving the appearance of an opening where none really exists.

Walls.—Ledges.—See Section 588.

Doors and Windows.—When Required to be Closed.—Fire-resisting Glass.—See Section 632.

Sec. 338. (**Emergency Exits.—Width.—Emergency Stairs.—Width.—Emergency Exits Inside Walls of Buildings.—Fire Escapes, Construction.—Fire Escapes Leading to Street or Alley.—Doors Open Outward.**)—Emergency exits and stairways shall be provided separately for each floor, balcony and gallery. They shall be of the same aggregate width as that provided for the main exits, and no emergency exit, doorway or stairway shall be less than three feet in width. Such emergency stairways shall be made of iron, steel or other incombustible materials. Such emergency exits shall be kept free of obstructions of any kind, including snow and ice.

Such emergency exits and stairways may be built inside the walls of the building, provided they are surrounded by a fireproof partition not less than four inches thick separating the exits and stairways from the audience room or auditorium.

If said emergency exits lead outside the building, the opening leading thereto shall have metal frames filled with wire glass doors opening outward, hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of the wall. Outside shutters will not be permitted, except when the same shall open automatically from the interior, without resistance, and when used or opened will automatically fasten, securely, flat against the wall, so as not to in any way obstruct the passage on the outside; all such automatic devices or attachments to said doors to be subject to the approval of the Commissioner of Buildings and the Fire Marshal of the City of Chicago.

As amended October 22, 1906.

Whenever any such emergency stairway passes over an exit door or window or other opening, such stairway shall be completely inclosed for a space of five feet greater in width than such opening by iron, steel or other incombustible material.

All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley and direct and immediate exit to such public thoroughfare shall not be obstructed by any doors, gates, bars or other obstruction of any character.

Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley or street, without entering into or passing through or over any building unless by a four-foot wide fireproof passage on the court or ground level.

All doors in openings from any and all exits and stairways shall be so constructed that when opened they shall not obstruct any portion of any other doorway, opening or passageway.

All doors affording ingress to or egress from any theater shall open outward upon suitable hinges.

Sec. 339. (**Exit Doors.—Particulars as to.**)—Exit doors shall not be obscured by draperies and shall not be locked or fastened in any manner during the entire time such theater is open to the public, so as to prevent them from being easily opened

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outwardly; and such door shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

Sec. 340. (Wall.—Brick Proscenium Wall Between Auditorium and Stage.—Steel Curtain Fireproofed on Stage Side.—No Combustible Material on Audience Side.—Plans for Curtain.—Permit from Building Department.—Inspection.—Fee.)—There shall be in every theater a solid brick wall of the same construction and thickness as is required in outside walls between the auditorium and the stage. The main proscenium opening shall have a substantial steel curtain vertically operated and fireproofed on the stage side, which shall be raised and lowered by mechanical power and which shall be in constant use as the regular curtain and act drop.

No combustible material other than painted decorations shall be applied to the audience side of such curtains.

Plans for such curtain shall be approved by the building department and a permit obtained for its erection. The building department shall inspect such curtain semi-annually, for which inspection a fee of two (2) dollars shall be charged.

All other openings in such proscenium wall shall have iron doors, frames and thresholds.

Sec. 341. (Stage, Construction Of.—Fireproof Paint.—Scenery.—How Treated.)—The framing of the floor of every stage shall be of iron or steel. The stage floor may be of wood, but shall not be less than two and three-fourths inches thick. The entire floor construction and floor of fly galleries, rigging lofts and paint gallery, all railings and supports and stanchions thereon, and all sheaves, pulleys and cables and their supports shall be of iron or steel. All woodwork, including the under side of floor boards, and all framing for scenery used on or about the stage shall be coated with a fireproof paint, the qualities of which shall be submitted to and approved by the Commissioner of Buildings. All wood used for floor and floor supports shall be coated on the under side with the same kind of paint.

No scenery or stage paraphernalia of any sort shall be used upon the stage of any room used for the purposes of Class V., unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

Sec. 342. (Vestibule of Stage Doors.)—All doorways or openings in the rear or sides of the stage shall be vestibuled or protected in a manner satisfactory to the Commissioner of Buildings, so as to protect the curtain, scenery and auditorium against draughts of air.

Sec. 343. (Vents, Flue Pipes, Size of.—Dampers.—Switches for Dampers.)—One or more vents or flue pipes, of metal construction, or other incombustible material suitable for carrying away smoke, approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof, and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional stories.

All such flues or vents shall be provided with metal dampers, and shall be opened by a closed circuit battery approved by the city electrician; such dampers shall be controlled by two switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the city fireman's station on the opposite side of the stage; such switches shall be located at such places on the stage as are designated by the fire marshal, and each shall have a sign with plain directions as to the operation of same printed thereon.

All fuse boxes shall be surrounded by two thicknesses of fireproof material, with an air space between, and no fuses shall be exposed to the air between the switchboards.

Sec. 344. (Automatic Sprinklers.—Location Of—Tank.—Connections.)—There shall be provided an approved system of automatic sprinklers, with approved automatic closed circuit electric devices connecting the valves regulating the flow of water in the various sprinkler pipes, with the headquarters of the city fire alarm telegraph and such other place or places as the Fire Marshal shall direct, so arranged as to prevent any tampering with the system or the shutting off of the water from the sprinkler pipes without automatic notice to the fire department.

Such system of automatic sprinklers shall be supplied with water from a tank located not less than twenty feet above the level of the highest sprinkler head in the system, and it shall be the duty of the fireman provided for in this chapter to include in his daily report the result of an inspection to determine the sufficiency of water in this tank. Automatic sprinklers shall be placed in the paint room, store-

room, property room, scene storage room, carpenter shop and dressing rooms, if such rooms are in or connected with a building used for the purposes of Class V., such tank shall not be connected with a standpipe and ladder system, but shall be filled through a separate pipe from a fire pump, and a three-inch iron pipe shall extend from such tank to the outside of such building, with Siamese connections for fire department use. Such entire automatic sprinkler system and equipment and the location thereof shall be subject to the approval of the Fire Marshal.

Sec. 345. (Fire Apparatus on Stage.—Hand Fire Pumps.—Fire Materials.—Hot Air Furnaces.)—A standpipe not less than two and one-half inches in diameter, having a hose valve or valves thereon, shall be installed on each side of the stage, with a hose connection at the stage and at each level above and below the stage, and hose connected thereto at each valve ready for use at all times. Such standpipe shall be connected with a tank on the roof containing not less than three thousand gallons of water, protected from frost, and also with a power pump, all of which shall be subject to the approval of the Fire Marshal. Portable fire extinguishers or hand fire pumps shall always be kept ready for use on and under the stage; in fly galleries and in rigging lofts, and in addition thereto at least four fire department axes and six pike poles shall be kept ready for use on each tier or floor of the stage, all of which shall be subject to the approval of the Fire Marshal.

The use of ordinary hot air furnaces or stoves is prohibited.

Sec. 346. (Exits.—Diagram Of, Printed on Program.)—It shall be the duty of the owner, lessee or manager of any theater, for any performance in which programs are issued, to cause to be printed on such programs, on the page opposite that upon which the cast is printed, a diagram showing conspicuously all exits of such building. A diagram of seats of each floor, and the exits leading from each floor drawn to a scale of one-eighth inch to the foot, shall be hung in a frame within two feet of the ticket seller's window and so as to be easily seen by the public.

Sec. 347. (Lighting.—Independent Lighting System for Exits.—Red Light Over Exits.)—All stairways and corridors shall be supplied with a supplementary lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building and shall be in operation during the entire period such theater is open to the public and until the audience has left the building. The word "EXIT" shall be in letters at least six inches high over the opening to every means of egress from such theater and a red light furnished by gas or sperm oil shall be kept burning over such word "EXIT" at every such opening, during the entire period such theater is open to the public and until the audience has left the building.

Sec. 348. (Fire Alarm Apparatus.)—Every theater shall be provided with an approved system of automatic or manual fire alarm telegraph apparatus, connected by the necessary wires with the headquarters of the city fire alarm telegraph, and such other place or places as the Fire Marshal may direct. The number and location of the boxes and the character of the system, whether automatic or manual, or both shall be determined by the Fire Marshal.

Sec. 349. (Firemen.—Employment of.—Duties.)—Amended by ordinance, June 8, 1908, to read as follows:

It shall be the duty of every person, firm or corporation conducting, operating or maintaining a theater to procure at his, their or its own expense, the attendance, at each and every performance, of one fireman who shall be detailed by the Fire Marshal from the regular City Fire Department; he shall be in the uniform of the Chicago Fire Department and he shall be on duty at such theater during the entire time it is open to the public. He shall report to and be subject to the orders of the Fire Marshal and shall see that all fire apparatus required by this Chapter is in its proper condition, ready for use and that all exit doors are unlocked during the entire time such theater is open to the public and are all in efficient and ready working order. During the performance he shall remain on the stage and shall generally perform such duties as may be required of him by the rules and regulations of the Fire Department governing firemen detailed at theaters.

It shall also be the duty of every person, firm or corporation conducting, operating or maintaining a theater to employ in addition to the fireman hereinbefore provided for, one other experienced and competent person as a private watchman or fireman who shall be approved by the Fire Marshal and who shall be in distinctive uniform and shall be on duty at such theater during the entire time it is open to the public. Such private watchman or fireman shall report and be subject to the orders of the Fire Marshal and it shall be his duty to see that the provisions of this Chapter are complied with in all portions of the theater occupied and used by the public, and that all exit doors are unlocked during the entire time such theater is open to the public, and in efficient and ready working order. The city fireman and Fire Marshal shall require a drill of the employees of such theater including such private watchman or fireman, in the use of all apparatus and appliance

for the prevention of fire inside the building and the saving of life, at least twice in every week, and such city fireman shall report to the Fire Marshal the manner and efficiency of such drill. Such city fireman shall report in writing daily to the Fire Marshal the condition and equipment of the theater to which he is detailed. No city fireman shall be on duty at any one theater for a longer period than two weeks.

The compensation to be paid the city for the services of such city fireman so detailed shall be based on the regular salary paid by the city to such fireman, and shall be computed according to the ratio between the number of hours such fireman is required by his duties hereunder to devote to such theater and the total number of hours such fireman is employed by the city for all purposes. All sums received by the city under the provisions of this section shall be for the use and benefit of the Fire Department.

Sec. 350. (Amusement License.)—The amusement license issued for each theater shall state the number of permanent seats the theater contains, which number shall be governed by the provisions of this ordinance relating thereto, and no more than that number of persons shall be permitted to be in such theater at any one time.

No license for the operation of a theater will be issued unless the Commissioner of Buildings, Fire Marshal and the City Electrician shall first have certified, in writing, that such theater complies with the provisions of this chapter in every respect.

Sec. 351. (Lighting.—All Parts Well Lighted During Performances.)—Every portion of any theater devoted to the use or accommodation of the public and all outlets therefrom leading to the streets, including all open courts, corridors, stairways, exits and emergency exit stairways, shall be well and properly lighted during every performance, and the same shall remain lighted until the entire audience has left the premises.

Sec. 352. (Lights.—Control of Lights in Halls, Corridors and Lobbies.—Separate Shut-off.—Connections with Gas Mains.—Independent Connections.—Protection of Suspended and Bracket Lights.—Protection of Lights Inserted in Walls.—Protection of Footlights.—Construction of Border Lights.—Ducts and Shafts Conducting Heated Air from Lights.—Gas Stage Lights to Have Metal Screens.)—All gas or electric lights in the halls, corridors, lobbies or any part of any theater used by the audience, except the auditorium, shall be controlled by a separate shut-off, located in the lobby, and controlled only in that particular place. Gas mains supplying such theater shall have independent connections for the auditorium and the stage, and provision shall be made for shutting off the gas from the outside of the building. All suspended or bracket lights surrounded by glass in the auditorium, or in any other part of the theater, shall be provided with proper wire netting underneath. No gas or electric lights shall be inserted in the walls, woodwork, ceilings, or in any part of the theater, unless protected by fireproof materials. In case gas is used the footlights, in addition to the wire network, shall be protected by a strong wire guard not less than two feet distant from such footlights, and the trough containing such footlights shall be formed of and surrounded by fireproof material. All border lights shall be constructed according to the best known method, and subject to the approval of the Fire Marshal and the City Electrician, and shall be suspended by wire rope. All ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double, with an air space between. All gas stage lights shall have strong metal wire guards or screens not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of the flames of such lights, and such guards or screens shall be soldered to the fixtures in all cases.

The use of calcium lights in any theater is prohibited. All arc lights used on the stage shall at all times be subject to the approval of the city electrician, and no arc lights shall be used on any stage unless approved by said city electrician.

Sec. 353. (Fire Apparatus.—Under Control of Fire Department.)—The standpipes, automatic sprinklers, gas pipes, electric wires, hose, footlights, fire alarm boxes, fireproof proscenium curtain, switch boxes, ventilators, controlling levers, axes and pike poles, and all apparatus for the extinguishing of fire or guarding against the same, as provided for by this chapter, shall be made and kept at all times in condition satisfactory to and under the control of the Fire Marshal.

Sec. 354. (Officers Empowered to Enter Buildings.)—The Commissioner of Buildings, Fire Marshal, City Electrician, Superintendent of Police, or any of them, and their respective assistants, shall have the right to enter any building used wholly or in part for the purposes of Class V., and any and all parts thereof, at any reasonable time, and at any time when occupied by the public, in order to examine such buildings; to judge of the condition of the same and to discharge their respective duties, and it shall be unlawful for any person to interfere with them, or any of them, in the performance of their duties.

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Sec. 355. (The Commissioner of Buildings, Fire Marshal, City Electrician or Superintendent of Police Shall Close Buildings for Violations.)—The Commissioner of Buildings, Fire Marshal, City Electrician and the Superintendent of Police, or any one of them, shall have the power and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Class V., closed, where it is discovered that there is any violation of any of the provisions of this chapter and keep same closed until such provisions are complied with.

Sec. 356. (License.—Mayor Shall Revoke.)—Upon a report to the Mayor by the Commissioner of Buildings, Fire Marshal, City Electrician or the Superintendent of Police that any requirement of this chapter, or that any order given by them or any of them in regard thereto has been violated, or not complied with, the Mayor shall revoke the license of any such theater or place of amusement so reported and cause the same to be closed.

Buildings of Class V. Hereafter Erected.

Sec. 357. The following provisions shall apply to buildings hereafter erected and used wholly or in part for the purposes of Class V.

Sec. 358. (Walls.—Outside Walls.—Structures Built Above.)—The outside walls of all such buildings, the roofs or ceilings of which are carried on trusses or girders of a span of fifty feet or more, shall be as follows:

If such walls are less than twenty-five feet high they shall not be less than twenty inches thick.

If they are more than twenty-five feet and less than forty-five feet high they shall be not less than twenty-four inches thick.

If they are more than forty-five feet and less than sixty feet high they shall be not less than twenty-eight inches thick.

If they are more than sixty feet and less than seventy-five feet high they shall be not less than thirty-two inches thick.

If they are more than seventy-five feet and less than ninety feet high, they shall be not less than thirty-six inches thick.

An increase of four inches in thickness of such walls shall be made in all cases where they are over one hundred feet long without cross walls of equal height.

The thickness of the enclosing or surrounding walls of rooms used for the purposes of Class V., where such rooms are less than fifty feet wide, may be reduced by four inches.

If one or more stories are built above any room devoted to the uses of Class V., and such stories are carried on trusses or girders, the thickness of walls shall be increased by four inches for each two stories or part thereof above such room.

If solid masonry buttresses are employed and placed eighteen feet or less apart, and extended to the foot of the trusses or girders carrying the ceiling, or if iron or steel columns are inserted in such walls for the support of the superstructure, and at distances not more than twenty-four feet between centers, and if such columns extend to and carry the superimposed trusses or girders, the thickness of such walls may be reduced in proportion to the increase of strength afforded by such buttresses or columns, but in no case shall any such wall be less than twelve inches thick in the top story, and four inches shall be added, going downward, for each story, for each gallery, or for each twenty-five feet in height of wall.

Sec. 359. (Columns in Walls.)—If iron or steel columns are introduced in such walls, the brickwork around such columns shall be bonded into the brickwork of the connecting wall, and each of such columns shall be fireproofed, as provided in Section 511 of this chapter.

Walls Around Stairs, Elevators and Shafts.—See Section 588.

Sec. 360. (Construction.—Frontage.—Open Spaces and Enclosed Passages.)—All buildings hereafter erected and used wholly or in part for the purposes of Class V. shall be built entirely of fireproof construction and shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street, and the other may be a public alley not less than ten (10) feet in width.

All floors, balconies and galleries of the audience room of every theater shall have open spaces or fireproof passageways on the three sides other than the proscenium; and on each of the two opposite sides other than the back and proscenium of every stage there shall be open spaces or fireproof passageways, and such open spaces or fireproof passageways shall open on or connect directly with the public thoroughfares.

All open spaces shall not be less than ten (10) feet in width and all fireproof passageways shall not be less than eight (8) feet in width, and shall be outside of the audience room, and shall be kept and maintained free and clear of obstructions of any and all kinds at any and all times.

Provided, however, that where said theater does not seat more than five hundred persons on the main floor, the width of such fireproof passageway on each side of the

auditorium on the main floor may be reduced to five feet for that portion of passageway immediately adjoining the auditorium.

The width of such passageways shall be increased twelve (12) inches for each 100 additional seating capacity or fraction thereof of such main floor, until the maximum now required by law, namely, eight (8) feet, is reached, but no such passageway shall be less than five (5) feet in width in this class.

As amended Nov. 25, 1907.

All open spaces shall be open and unobstructed from the floor or pavement of such space to the sky, with the exception that emergency stairs and emergency balconies may be built in such open spaces. The entire floor of every open space shall be level or inclined; the incline shall not exceed two (2) inches in height for each one foot of horizontal measurement.

If one or more fireproof passageways are required on one side of the stage, then the fireproof passageways of each floor and the balcony and each gallery of the audience room shall be continued through the stage house as fireproof passageways to an open space or public thoroughfare, and from the end of each such fireproof passageway there shall be doors or stairs, or both, which shall be arranged so as to afford a safe exit for the audience of such theater to the pavement of the public thoroughfares, and if fireproof passageways are required on both sides of the stage, then they shall be arranged and connected with all of the fireproof passageways on both sides of the audience room in the same manner as described for fireproof passageways when these are required only on one side of the stage.

The fireproof passageways for the main floor may pass under the stage floor.

Provided, however, that where there is no public thoroughfare or open space at the back of the stage and on one side of the stage, then the fireproof passageways for the main floor shall be on the stage floor and shall be built along that side of the stage on which there is no public thoroughfare and across the back of the stage to one of the public thoroughfares, and the fireproof passageways for the balcony and the fireproof passageways for the galleries shall each be built along the side of the stage and across the back of the stage, in a continuation of the balcony and gallery floor level to a public thoroughfare.

The fireproof passageways of the different floors, of the balcony and of the galleries, shall be independent of each other and shall not be connected with each other in any manner.

No doors or other openings except entrance doors from the audience room or exit doors to a thoroughfare shall be in the walls of a fireproof passageway; and all such doors shall be so arranged that when open they shall not obstruct the passage.

The walls of a fireproof passageway shall be not less than four (4) inches thick, and each and every part of such passageway, including each and all of its supports, shall be built of fireproof construction as required in the general provisions relating to fireproof construction of this chapter.

Radiators for warming passageways shall be in recesses.

There shall be no steps or risers in a fireproof passageway, but where necessary inclined floors of the full width of the fireproof passageways may be built; the incline of the floor shall not exceed two and one-half (2½) inches in height per foot, measured horizontally, and no such incline shall be less than ten (10) feet in length. No fireproof passageway shall be less than eight (8) feet high in any part thereof, except at doors, and these shall not be less than seven (7) feet high.

If the principal entrance corridor of a theater is at one side of the audience room, then the center line extended of such principal entrance shall intersect the center axis of the stage and the audience room between the back of the seat most remote from the stage on said center axis of the stage and the audience room, and a point midway between such seat and the wall opposite the proscenium wall.

Sec. 361. (Buildings of Other Classes Built in Conjunction With Class V.—Construction of.)—If buildings used wholly or in part for purposes of Class V. are built in conjunction with or as part of buildings devoted to the uses of other classes, then such buildings of other classes shall be built entirely of fireproof construction.

Sec. 362. (Floor Levels.—Limitation Of.)—In all cases where the floors of the auditorium of any theater in any such building of Class V. are banked or stepped up, the floor level of the lowest bank shall not be above the sidewalk level.

All floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

The audience room or rooms or auditorium or auditoriums used for the purposes of Class V. containing, in the aggregate, not more than five hundred seats, if in a fireproof building, may be located in any story thereof, but in such case there shall be at least two separate stairways from the floor or floors in which such audience

room or auditorium is located to the ground, each of which stairways shall be not less than four feet in width in the clear.

Sec. 363. (Stairways.—Entrances and Exits.)—Stairways affording ingress to or egress from any room used for the purposes of Class V. shall be in width equivalent to twenty inches for every one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches of width shall be added, but in no event shall any such stairway be less than four feet wide in the clear, except as hereinafter provided.

All such stairways shall have hand railings on each side thereof, and shall not ascend a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall be not less than the width of the stairs; no run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over seven feet wide shall have double intermediate handrails with end newel posts at least five and a half feet high.

Steps shall not have a greater rise than seven and three-eighths inches, treads shall not be narrower than eleven inches, and winders shall not be used on any staircase.

Each and every balcony and gallery shall have separate and distinct entrances and stairways from the sidewalk level. The bottom run of the stairs shall be directly toward the street. Such stairs may ascend from the vestibule or entrance inside of the building, but the bottom riser of such stairs shall be not more than sixty-five feet from the building line. All doors between such stairs and the street shall be kept unlocked and unfastened during each and every performance and until the audience has left the building.

There shall be an iron stairway or stairways from the stage to the fly gallery and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairways may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

Stairs leading to a box or boxes seating not to exceed thirty people in the aggregate shall be independent of all other stairs and seats, and not less than two feet eight inches wide in the clear. For each additional twenty-five of seating capacity or major portion thereof in such box or boxes there shall be an additional five inches in width of such stairway.

All stairways on the stage side of the proscenium wall shall be not less than two feet six inches wide.

Sec. 364. (Floors at Exits—Seating.)—Floors at all exits shall be so designed as to be level and flush with adjacent floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

More than ten seats in any one row between aisles shall not be lawful.

Seats shall be not less than twenty-two inches in width, measured at the top of the seat backs.

Rows of seats shall not be less than two feet ten inches from back to back.

No bank of seats shall have a greater rise than twenty-two inches.

All groups of seats shall be so arranged that there shall be an aisle at each side of each group, provided groups of five seats or less may abut upon a tunnel at one side and an aisle at the other side.

The number of banks of seats on the main floor shall not exceed fifteen, unless an intervening or cross aisle is provided between each fifteen banks of seats or a direct exit is provided for each aisle. The number of banks of seats in the "balcony" shall not exceed nine, unless an intervening or cross aisle is provided between each nine banks of seats or a direct exit is provided for each aisle.

Sec. 365. (Tunnels.—Cross Aisles.—Vertical Rise.—Foyer.)—There shall be no more than eleven feet rise, measured vertically, in any aisle in any gallery without a direct exit by tunnel or otherwise, to a corridor with free opening on to the gallery stairs or other direct discharge to the street, or at any such elevation of eleven feet an intervening or cross aisle leading directly to an exit. No tunnel shall be less than three feet wide in the clear.

No foyer shall be open to the theater proper except through the exits.

Sec. 366. (Main Floor.—Balcony and Gallery.—Designation Of.)—The lower floor shall be designated the "Main floor."

Where there are balconies or galleries the first balcony or gallery shall be designated the "Balcony," and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery." Such designation shall be printed plainly on all admission tickets.

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Sec. 367. (Aisles and Passageways.—Kept Unobstructed.—Steps in Aisles.)—The minimum width of aisles with diverging sides in any room or auditorium used for the purposes of Class V. shall be two feet eight inches at the end near the stage, and not less than three feet at the other end.

The minimum width of aisles with parallel sides shall be three feet.

Every aisle shall lead directly to an exit. Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be more than seven and three-eighths inches in height, and no tread shall be less than ten inches in width, and whenever the rise from bank to bank of seats is less than five inches, the floor of the aisles shall be made as an inclined plane; and where steps are placed in outside aisles or corridors they shall not be isolated, but shall be grouped together, and a light shall be maintained so that every place where there are steps in enclosing aisles or corridors shall be clearly lighted. All aisles, passageways, corridors and exits shall be kept free from camp stools, chairs, sofas and other obstructions, and no person shall be allowed to stand in or occupy any such aisles, passageways, corridors or exits during any performance, service, exhibition, lecture, concert or at any public assemblage.

Sec. 368. (Corridors.—Passageways.—Hallways and Doors.—Width of Entrance Doors.)—The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting, however, that no corridors shall be anywhere less than four feet in width and no doorway less than three feet wide, except as otherwise herein provided.

All corridors, passageways, hallways and stairways leading from any balcony or gallery to any toilet room, retiring room, smoking room, cloak room, check room or private office shall permit of free passage, without returning, to an outer exit of the building. Such corridors, passageways, hallways and stairways shall be at least three feet in width in every part between such balcony or gallery and such outer exit, and shall be unobstructed in every part, except by doors not less than three feet in width in the clear, which shall swing outward and which shall not be provided with locks or catches of any kind whatever.

The entrance doors to every theater shall be of sufficient width to accommodate the entire audience, computed on the basis of twenty inches of width in the clear to each one hundred permanent seats or proportionate part thereof in the audience room or auditorium of such theater, and all doors shall be so arranged that when open they shall not obstruct any corridor or passage whatsoever into which they open.

No mirrors shall be so arranged as to give the appearance of a doorway, exit, hallway or corridor, when no such doorway, exit, hallway or corridor is really in existence, nor shall there be any false doors or windows giving the appearance of an opening where none really exists.

Sec. 369. (Emergency Exits, Width.—Emergency Stairs, Width.—Emergency Exits Inside Walls of Buildings.—Fire Escapes, Construction.—Fire Escapes Leading to Street or Alley.—Doors Open Outward.)—Emergency exits and stairways shall be provided separately for each floor, balcony or gallery. They shall be of the same size as that provided for the main exits, and no emergency exit, doorway or stairway shall be less than three feet in width. Such emergency stairway shall be made of iron, steel or other incombustible material. Such emergency exit shall be kept free of obstructions of any kind, including snow and ice.

Such emergency exits and stairways may be built inside the walls of the building, provided they are surrounded by a fireproof partition not less than four inches thick, separating the exits and stairways from the audience room or auditorium.

If such emergency exits lead outside the building, the openings leading thereto shall have metal door frames and metal doors with panels filled with fire-resisting glass, opening outward, hung from the inside corner of the jambs, and so constructed as not to project when opened beyond the outside face of the wall, and outer shutters shall not be permitted.

Whenever any such emergency stairway passes over an exit or door or window or other opening, such stairway shall be completely enclosed for a space of five feet greater in width than such opening, by iron, steel or other incombustible material.

All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any door, gate, bars or other obstruction of any character.

Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley or street without entering into or passing through or over any building unless by a four-foot wide fireproof passage on the court or ground level.

All doors in openings from emergency exits and stairways shall be so constructed that when opened they will not obstruct any portion of any other doorway, opening or passageway.

All doors affording ingress to or egress from any theater shall open outward upon suitable hinges.

Exit doors shall not be obscured by draperies and shall not be locked or fastened in any manner during the entire time such theater is open to the public, so as to prevent them from being easily opened outwardly; and such doors shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

Sec. 370. (Wall.—Brick.—Proscenium Between Auditorium and Stage.—Steel Curtain Fireproofed on Stage Side.—No Combustible Material on Audience Side.—Plans for Curtain.—Permit from Building Department.—Inspection Fee.)—There shall be a solid brick wall of the same construction and thickness as is required in the outside walls of the building in which such theater is located between the auditorium and the stage.

The main proscenium opening shall have a vertically operated steel curtain which shall, when it is lowered, completely close such proscenium opening. The curtain shall be raised and lowered by mechanical power, other than hand power, as the regular curtain and act drop each and every time there is an audience in the theater.

The lowering of the curtain shall be controlled from not less than two points in the building, one of which shall be designated by the Commissioner of Buildings.

The curtain shall have a steel covering on the outer or auditorium side. The stage side covering shall be of a non-conducting substance of such a thickness and such material as shall stand a test of two thousand degrees F. on the stage side for fifteen minutes and without heating the opposite side to a higher temperature than three hundred and fifty degrees F.

All metal work with the exception of the frame shall be covered with a non-conducting substance on the stage side.

The curtain shall operate vertically in steel guides of such a cross section that the edges shall engage and secure the edges of the curtain and prevent the curtain from leaving the guiding channel or channels if the curtain should tend to buckle or bag either inward or outward. No metal in the guide channels or in the engaging edge of the curtain shall be less than three-eighths ($\frac{3}{8}$) of an inch thick. The joints of the curtain with the proscenium wall, with the stage floor and with the head of the opening shall be made gas tight as nearly as practicable.

The calculations for the strength of the curtain, the curtain guides and the guide anchors, and the workmanship shall be according to the best modern engineering practice, the stresses in the material and in the various sections of steel shall be within the safe limits of stress described in this ordinance.

No part of a curtain or of the curtain guides shall be supported by or fastened to any combustible material.

The supports of the curtain and the curtain guides and edges and the curtain shall be of sufficient strength to safely resist a pressure of twenty (20) pounds for each and every square foot of the curtain either inward or outward, if such curtain does or does not bag.

No combustible material other than painted decorations shall be applied to the audience side of any such curtain.

Plans for every such curtain shall be approved by the Building Department and a permit obtained for its erection. The Building Department shall inspect such curtain semi-annually, and for each such inspection a fee of two (2) dollars shall be charged.

All other openings in such proscenium wall shall have self-closing, regulation standard iron fire doors and iron frames and thresholds; such doors and frames shall be built in such a manner as to resist warping.

Sec. 371. (Stage, Construction of.—Fireproof Paint.—Scenery.—How Treated.)—The framing of the floor of every stage shall be of iron or steel or fireproof material. The stage floor may be of wood, but shall not be less than two and three-fourths inches thick. The entire floor construction and floor of fly galleries, rigging lofts and paint galleries, all railings and supports and stanchions thereon, and all sheaves, pulleys and cables and their supports shall be of iron or steel. All woodwork, including the under side of floor boards, and all framing for scenery used on or about the stage shall be coated with a fireproof paint, the qualities of which shall be submitted to and approved by the Commissioner of Buildings. All wood used for floor and floor supports shall be coated on the under side with the same kind of paint.

No scenery or stage paraphernalia of any sort shall be used upon the stage of any room used for the purposes of Class V., unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

Sec. 372. (Vestibules for Stage Doors.)—All doorways or openings in the rear or sides of the stage shall be vestibuled or protected in a manner satisfactory to

the Commissioner of Buildings, so as to protect the curtain, scenery and auditorium against draughts of air.

Sec. 373. (Structures Over Ceiling.—Construction.)—If any structure is built over the ceiling or roof of any theater, the different members of the girders or trusses supporting same shall have their fireproofing double, in the manner prescribed for columns of fireproof buildings as specified in the General Provisions of this chapter.

Sec. 374. (Vents.—Size Of.—Flue Pipes.—Dampers.—Switches for Dampers.)—One or more vents or flue pipes of metal construction, or other incombustible material, suitable for carrying away smoke, and approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof, and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls, and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional story.

All such flues or vents shall be provided with metal dampers, and shall be opened by a closed circuit battery, approved by the City Electrician.

Such dampers shall be controlled by two switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the city fireman's station, on the opposite side of the stage; such switches shall be located in such places on the stage as are designated by the Fire Marshal, and each shall have a sign with plain directions as to the operation of the same printed thereon.

All fuse boxes shall be surrounded by two thicknesses of fireproof material, with an air space between, and no fuses shall be exposed to the air between the switchboards.

Sec. 375. (Automatic Sprinklers.—Location.—Tank.—Connections.)—There shall be provided an approved system of automatic sprinklers with approved automatic closed circuit electric devices connecting the valves, regulating the flow of water into the various sprinkler pipes with the headquarters of the city fire alarm telegraph, and such other place or places as the Fire Marshal shall direct, so arranged as to prevent any tampering with the system or the shutting off of the water from the sprinkler pipes without automatic notice to the fire department.

Such system of automatic sprinklers shall be supplied with water from a tank located not less than twenty feet above the level of the highest sprinkler head in the system, and it shall be the duty of the firemen provided for in this chapter to include in their daily report the result of an inspection to determine the sufficiency of water in this tank. Automatic sprinklers shall be placed in the paint room, store room, property room, scene storage room, carpenter shop and dressing rooms, if such rooms are in or connected with a building used for the purposes of Class V. Such tank shall not be connected with a standpipe and ladder system, but it shall be filled through a separate pipe from a fire pump, and a three-inch iron pipe shall extend from such tank to the outside of such building with Siamese connections for fire department use. Such entire automatic sprinkler system and equipment and the location thereof shall be subject to the approval of the Fire Marshal.

Sec. 376. (Fire Apparatus on Stage.—Hand Fire Pumps.—Fire Materials.—Hot Air Furnaces.)—A standpipe not less than three inches in diameter, having a hose valve or valves thereon shall be installed on each side of the stage with a hose connection at the stage and at each level above and below the stage, and hose connected thereto at each valve ready for use at all times. Such standpipes shall be connected with a tank on the roof containing not less than three thousand gallons of water, protected from frost, and such tank shall be connected with and supplied by a power pump, all of which shall be subject to the approval of the Fire Marshal. Portable fire extinguishers or hand fire pumps shall always be kept ready for use on and under the stage, in fly galleries and in rigging loft, and in addition thereto at least four fire department axes and six pike poles shall be kept ready for use on each tier or floor of the stage, all of which shall be subject to the approval of the Fire Marshal.

The use of ordinary hot air furnaces or stoves is prohibited.

Sec. 377. (Exits—Diagram of.—Printed on Programs.)—It shall be the duty of the owner, lessee or manager of any theater, for any performance in which programs are issued, to cause to be printed on such programs on the page opposite that on which the cast is printed, a diagram showing conspicuously all exits of such building. A diagram of seats on each floor, and the exits leading from each floor, drawn to a scale of one-eighth inch to the foot, shall be hung in a frame within two feet of the ticket seller's window and so as to be easily seen by the public.

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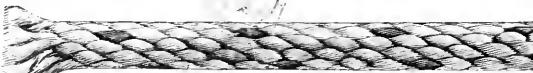
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Sec. 378. (Independent Lighting System for Exits.—Red Light Over Exits.)—All stairways and corridors shall be supplied with a supplementary lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building, and shall be in operation during the entire period such theater is open to the public and until the audience has left the building. The word "EXIT" shall be in letters at least six inches high over the opening to every means of egress from such theater and a red light, furnished by gas or sperm oil, shall be kept burning over such word "EXIT" at every such opening, during the entire period such theater is open to the public and until the audience has left the building.

Sec. 379. (Fire Alarm Apparatus.)—Every theater shall be provided with an approved system of automatic or manual fire alarm telegraph apparatus, connected by the necessary wires with the headquarters of the city fire alarm telegraph and such other place or places as the Fire Marshal shall direct. The number and location of the boxes and the character of the system, whether automatic or manual or both, shall be determined by the Fire Marshal.

Sec. 380. (Firemen.—Employment of.—Duties.)—Amended by ordinance June 8, 1908, to read as follows:

It shall be the duty of every person, firm or corporation conducting, operating or maintaining a theater to procure at his, their or its own expense, the attendance at each and every performance, of one fireman who shall be detailed by the Fire Marshal from the regular City Fire Department; he shall be in the uniform of the Chicago Fire Department and he shall be on duty at such theater during the entire time it is open to the public. He shall report to and be subject to the orders of the Fire Marshal and shall see that all fire apparatus required by this Chapter is in its proper condition, ready for use and that all exit doors are unlocked during the entire time such theater is open to the public and are all in efficient and ready working order. During the performance he shall remain on the stage and shall generally perform such duties as may be required of him by the rules and regulations of the Fire Department governing firemen detailed at theaters.

It shall also be the duty of every person, firm or corporation conducting, operating or maintaining a theater to employ, in addition to the fireman hereinbefore provided for, one other experienced and competent person as a private watchman or fireman who shall be approved by the Fire Marshal and who shall be in distinctive uniform and shall be on duty at such theater during the entire time it is open to the public. Such private watchman or fireman shall report and be subject to the orders of the Fire Marshal and it shall be his duty to see that the provisions of this Chapter are complied with in all portions of the theater occupied and used by the public, and that all exit doors are unlocked during the entire time such theater is open to the public, and in efficient and ready working order. The city fireman and Fire Marshal shall require a drill of the employes of such theater, including such private watchman or fireman, in the use of all apparatus and appliances for the prevention of fire inside the building and the saving of life, at least twice in every week, and such city fireman shall report to the Fire Marshal the manner and efficiency of such drill. Such city fireman shall report in writing daily to the Fire Marshal the condition and equipment of the theater to which he is detailed. No city fireman shall be on duty at any one theater for a longer period than two weeks.

The compensation to be paid the city for the services of such city fireman so detailed shall be based on the regular salary paid by the city to such fireman and shall be computed according to the ratio between the number of hours such fireman is required by his duties hereunder to devote to such theater and the total number of hours such fireman is employed by the city for all purposes. All sums received by the city under the provisions of this section shall be for the use and benefit of the Fire Department.

Sec. 381. (Amusement License.)—The amusement license issued for each theater shall state the number of permanent seats it contains, which number shall be governed by the provisions of this chapter relating thereto, and no more than that number of persons shall be permitted in such theater at any one time.

No license for the operation of a theater shall be issued unless the Commissioner of Buildings, Fire Marshal and City Electrician shall first have certified, in writing, that such theater complies with the provisions of this chapter in every respect.

Sec. 382. (Lighting.—All Parts Well Lighted During Performances.)—Every portion of any theater, devoted to the uses or accommodation of the public, and all outlets therefrom, to the streets, including open courts, corridors, stairways, exits and emergency exit stairways, shall be well and properly lighted during every performance, and the same shall remain lighted until the entire audience has left the premises.

Sec. 383. (Lights, Control of Lights in Halls, Corridors and Lobbies.—Separate Shut-off.—Connections With Gas Mains.—Independent Connections.—Protection of Suspended and Bracket Lights.—Protection of Lights Inserted in Walls.—Protection of Footlights.—Construction of Border Lights.—Ducts and Shafts Conducting Heated Air

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from Lights.—Gas Stage Lights to Have Metal Screens.)—All gas or electric lights in the halls, corridors, lobbies or any other part of any theater used by the audience, except the auditorium, shall be controlled by a separate shut-off located in the lobby and controlled only in that particular place. Gas mains supplying such theater shall have independent connections for the auditorium and the stage and provision shall be made for shutting off the gas from the outside of the building. All suspended or bracket lights surrounded by glass, in the auditorium, or in any other part of the theater, shall be provided with proper wire netting underneath. No gas or electric lights shall be inserted in the walls, woodwork, ceiling, or in any part of the theater unless protected by fireproof materials. In case gas is used, for the footlights, in addition to the wire network, they shall be protected by a strong wire guard, not less than two feet distant from such footlights, and the trough containing such footlights shall be formed of and surrounded by fireproof material. All border lights shall be constructed according to the best known methods, and subject to the approval of the Fire Marshal and the City Electrician, and shall be suspended by wire ropes. All ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double, with an air space between. All gas stage lights shall have strong wire metal guards or screens, not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of the flames of such lights, and shall be soldered to the fixtures in all cases.

The use of calcium lights in any theater is prohibited. All arc lights used on the stage shall be at all times subject to the approval of the City Electrician, and no arc lights shall be used on any stage unless approved by the City Electrician.

Sec. 384. (Fire Apparatus to Be Under Control of Fire Department.)—The stand-pipes, automatic sprinklers, gaspipes, electric wires, hose, footlights, fire alarm boxes, fireproof proscenium curtains, switch boxes, ventilators, controlling levers, axes and pike poles, and all apparatus for the extinguishing of fire or guarding against same, as provided for by this chapter, shall be made and kept at all times in condition satisfactory to and under control of the Fire Marshal.

Sec. 385. (Officers Empowered to Enter Buildings.)—The Commissioner of Buildings, Fire Marshal, City Electrician, Superintendent of Police, or any of them, and their respective assistants, shall have the right to enter any buildings used wholly or in part for the purposes of Class V., and any and all parts thereof, at any reasonable time, and at any time when occupied by the public, in order to examine such buildings and to judge of the condition of the same and to discharge their respective duties, and it shall be unlawful for any person to interfere with them or any of them in the performance of their duties.

Sec. 386. (The Commissioner of Buildings, Fire Marshal, City Electrician or Superintendent of Police Shall Close Buildings for Violations.)—The Commissioner of Buildings, Fire Marshal, City Electrician or Superintendent of Police, or any of them, shall have the power and it shall be their joint and several duty to order any building used wholly or in part for the purposes of Class V. closed, where it is discovered that there is any violation of the provisions of this chapter, and to keep same closed until such provisions are complied with.

Sec. 387. (License.—Mayor Shall Revoke.)—Upon a report to the Mayor by the Commissioner of Buildings or Fire Marshal or City Electrician or the Superintendent of Police that any requirement of this chapter, or that any order given by them or any of them, in regard thereto, has been violated, or not complied with, the Mayor shall revoke the license of any such theater or place of public amusement so reported and cause the same to be closed.

ARTICLE IX.

PROVISIONS RELATING SOLELY TO CLASS VI.

In Class VI. shall be included every tenement and apartment house; that is to say, any house or building, or portion thereof, which is used as a home or residence for two or more families living in separate apartments.

Sec. 388. (Walls of Class VI.—Thickness of.)—Buildings of Class VI. shall conform to the following requirements:

The thickness of enclosing walls of buildings of Class VI shall be made in accordance with the following table, to wit:

| Basement. | STORIES | | | | | | | | | | | |
|--------------|---------|----|----|----|----|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Basement and | 12 | 8 | | | | | | | | | | |
| Two-story | 12 | 12 | 8 | | | | | | | | | |
| Three-story | 16 | 12 | 12 | 12 | | | | | | | | |
| Four-story | 20 | 16 | 16 | 12 | 12 | | | | | | | |
| Five-story | 20 | 16 | 16 | 16 | 12 | 12 | | | | | | |
| Six-story | 20 | 20 | 16 | 16 | 16 | 12 | 12 | | | | | |
| Seven-story | 24 | 24 | 20 | 20 | 16 | 16 | 12 | 12 | | | | |
| Eight-story | 24 | 24 | 24 | 20 | 20 | 16 | 16 | 12 | 12 | | | |
| Nine-story | 28 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 12 | 12 | | |
| Ten-story | 28 | 24 | 24 | 24 | 20 | 20 | 16 | 16 | 12 | 12 | | |
| Eleven-story | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 16 | 16 | 12 | 12 | |
| Twelve-story | 32 | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 16 | 16 | 12 | 12 |

Provided, however, in buildings of steel skeleton fireproof construction, thickness of walls shall be governed by the provisions of Section 510 of this chapter.

Walls Around Stairs, Elevators and Shafts.—See Section 588.

Walls.—Reinforced Concrete.—See Section 554.

Sec. 389. (**Definitions.**)—"New tenement house" includes every tenement house hereafter erected and every such new tenement house which shall be increased or diminished in size or otherwise altered after its erection, and every building now or hereafter in existence not now used as a tenement house, but hereafter converted or altered to such use.

"Apartment" is a room or suite of two or more rooms occupied or intended or designed to be occupied as a family domicile.

"Yard" is an open, unoccupied space on the same lot with a tenement house, separating every part of every building on the lot from the rear line of the lot.

"Court" is an open, unoccupied space, other than a yard, on the same lot with a tenement house; a court entirely surrounded by a tenement house is an "inner court;" a court bounded on one side and both ends by a tenement house and on the remaining side by a lot line is a "lot line court;" a court extending to a street, alley or yard is an "outer court."

"Shaft" includes exterior and interior shafts, whether for air, light, elevator, dumb waiter or any other purpose; a "vent shaft" is one used solely to ventilate or light a water closet compartment, bath room, or pantry.

"Public Hall" is a hall, corridor or passageway, not within an apartment.

"Stair Hall" includes the stairs, stair landings, and those portions of the public halls through which it is necessary to pass in getting from the entrance floor to the top story.

"Basement" is a story partly, but not more than one-half—"Cellar" is a story more than one-half—below the level of the street grade nearest the building; where the grade of a street adjacent to a tenement house varies, the mean or average grade of such street opposite the lot containing the tenement house shall be regarded as the grade of such street within the meaning of this chapter.

"Story" is that portion of a building between the top of any floor beams and the top of the floor or ceiling beams next above.

A good quality of brick, laid in lime mortar, of strength and character equal to the requirements of Section 587 of this chapter, for brick walls, shall be taken as the standard of strength and stability for "solid masonry," but any other fireproof materials of equal strength and stability to the above standard may be substituted for brick.

Sec. 390. (**Construction of Partitions Between Apartments in Frame Buildings.**)—Every new tenement house more than five stories and basement high shall be of fireproof construction (according to the definition of "fireproof construction" contained in Section 500 of this chapter); every new tenement house more than three stories and basement high, but not more than five stories and basement high, shall be of "slow-burning" or "fireproof construction" (according to the definition of "slow-burning" or "fireproof construction" as defined in this chapter). In case slow-burning construction be used the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction. *In all new frame tenement houses outside the fire limits of the city each suite of apartments shall be separated from the next suite in such building by a wall of four-inch tile or metal studding and metal lath.*

As amended by ordinance of October 22, 1906.

In all new frame tenement houses outside the fire limits of the city, each suite of apartments shall be separated from the next suite in such building by a wall of incombustible material of such character as the Commissioner of Buildings may require.

Sec. 391. (**Joists.—Supports for.**)—If in buildings of Class VI. the distance between the enclosing walls is more than twenty-four feet in the clear, there shall be intermediate supports for the joists, which supports shall be either brick walls or iron or steel. If brick walls are used for this purpose they may, in all cases where the thickness of walls is given in the table as 16 inches or more, be made 4 inches less in thickness than the dimensions stated in the table.

Walls.—Ledges in.—See Section 588.

Sec. 392. (**Fire Escapes.**)—Every tenement house four or more stories in height shall be provided with a fire escape or fire escapes, such as are required by the statutes of this state and the ordinances of the city. In every case each separate apartment shall have direct access to at least one such fire escape unless such apartment shall have direct access (without passing through any other apartment) to at least two separate flights of stairs leading to the ground, one of which is placed in front and one in the rear of such building, and one of which may be placed outside of the building; but where such separate apartment shall not have access to two such flights of stairs, then there shall be a metal stairway between the balconies of every such fire escape, securely fastened to the walls of the building not less than two feet wide, with a proper hand rail, instead of the usual vertical ladder. Every court in which there shall be a fire escape shall have direct and unobstructed access along the surface of the ground to a street, alley, or yard opening into the alley or street, without entering into or passing through or over any building, unless by a four-foot wide fireproof passage on the court or ground level.

Sec. 393. (**Fire Escapes to Be Painted.**)—Every new fire escape shall be painted with two coats of durable paint, one put on in the shop and the other at once upon the erection of such fire escape.

Sec. 394. (**Bulkheads and Scuttles.—Stairs to.**)—Every tenement house shall have in the roof a bulkhead or scuttle, fireproof or covered with fireproof materials, with stairs or ladder leading thereto; no such roof opening shall be less than two feet by three feet. No scuttle or bulkhead door shall have upon it any lock, but may be fastened on the inside by movable bolts or hooks.

Sec. 395. (**Stairs and Halls.—In Case of Alterations.—Requirements.**)—Every now existing and every new tenement house shall have at least two flights of stairs, which shall extend from the entrance floor to the top story. Such stairs and the public halls in every tenement house shall each be at least three feet wide in the clear, and every apartment shall be directly accessible from both such flights of stairs. If any existing tenement house be so altered as to increase the number of apartments therein, or if such building be increased in height, or if the halls and stairs therein be damaged by fire or otherwise to an extent greater than one-half the original cost thereof, the entrance, stair halls, entrance halls and other public halls of the whole building shall be made to conform to the requirements of this chapter as to new tenement houses.

Sec. 396. (**Railings and Guards.**)—In every tenement house all stairways shall be provided with sufficient railings and guards.

Sec. 397. (**Stairs in Non-Fireproof Buildings, Eighty to One Hundred and Twenty Rooms.**)—Every new non-fireproof tenement house containing over eighty rooms, exclusive of bath rooms, shall have one additional flight of stairs (over and above the flights hereinbefore provided for) for every additional eighty rooms, or fraction thereof; but if such building contains not more than one hundred and twenty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building shall be at least one-half wider than is provided in Sections 395 and 402 of this chapter.

Sec. 398. (**Stairs in Fireproof Buildings One Hundred and Twenty Rooms and Upward.**)—Every new fireproof tenement house containing over one hundred and twenty rooms, exclusive of bath rooms, shall have one additional flight of stairs (over and above the flights hereinbefore provided for) for every additional one hundred and twenty rooms or fraction thereof; but if such building contains not more than one hundred and eighty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building shall be made at least one-half wider than is provided in Sections 395 and 402 of this chapter.

Sec. 399. (**Stairs.—Entrance to.—Treads and Risers.**)—Every flight of stairs required in a tenement house shall have an entrance on the entrance floor from a street or alley, or from a yard or court which opens into a street or alley. All stairs except rear stairs, in new tenement houses, shall have risers not more than seven and three-quarters inches high and treads not less than nine and one-half inches wide exclusive of nosings, except in winding stairs, where all treads at a point eighteen inches from the strings on the well side shall be at least nine and one-half inches wide, exclusive of nosings.

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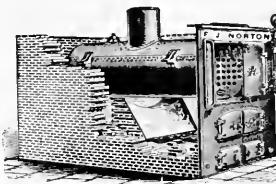
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Sec. 400. (Stairs and Stair Halls.—Over Three Stories.—Fire-Resisting Glass.)—The stairs and stair halls in all new tenement houses more than three stories and basement high shall be constructed of incombustible material throughout, except that the treads of stairs (not less than one and three-fourths inches thick) and all hand rails, may be of hard wood. All windows in stair halls in new tenement houses more than three stories and basement high opening on inner courts or shafts shall be of good quality fire-resisting glass.

Sec. 401. (Stair Halls Enclosed in Masonry.—Requirements and Exceptions.)

Amended by ordinance of February 18, 1907, to read as follows:

In every new non-fireproof tenement house all stair halls shall be enclosed on all sides with the walls of solid masonry of the same dimensions and thickness as specified for enclosing walls. All windows in such stair halls shall have metal frames and sashes, glazed, fire-resisting glass and such windows shall be stationary. This section shall not apply to tenement houses which are not more than three (3) stories and basement high with only one apartment on each floor.

Sec. 402. (Entrance Halls.—Solid Masonry.—Exceptions.—Ceilings.)—Every main entrance hall in a new tenement house shall be at least three feet six inches wide in the clear from the entrance up to and including the stair enclosure, and beyond this point at least three feet wide in the clear. In every new non-fireproof tenement house, except where there is only one apartment on each floor, such entrance hall shall be inclosed with solid masonry walls and with ceilings covered with incombustible material and shall comply with all the conditions of the preceding sections of this chapter as to the construction of stair halls. If such main entrance hall is the only entrance to more than one flight of stairs, the several portions of such main entrance hall which separate the entrance of the building from the several flights of stairs respectively shall be increased respectively at least one foot in width for each additional flight of stairs.

Sec. 403. (Frame Buildings Not to Be Enlarged.)—No wooden frame tenement house within the fire limits shall be enlarged either by adding to its height or to its superficial area.

Sec. 404.—(Bay Windows—Vent Shafts.—Openings.)

Amended by ordinance of February 8, 1907, to read as follows:

All bay windows and all shafts and courts, in masonry constructed new tenement houses, shall have the walls of the bay windows, shafts and courts built of brick or other fireproof construction throughout. This section shall not apply to enclosures about elevators which are in common with a stairway surrounded and enclosed in masonry walls.

Sec. 405. (Apartments Divided by Masonry.)—There shall be a wall of solid masonry of the same thickness as required for outside walls in buildings of this character, extending from the ground to the roof between each set of apartments and around each well hole, court or light shaft; provided, however, that the wall between apartments above the first story extending from a main stair hall to the outer wall of the building may jog or set over to some point toward the center of the building to provide or allow for an even distribution of space of the rooms adjacent to the same; provided, however, that such wall above the first story, if supported on iron or steel beams (which shall extend from the brick wall surrounding the main stair hall to the outer wall of the building at each succeeding story), shall be not less than eight inches in thickness, but all brick walls between apartments and around each well hole, court or light shaft which extend from the ground to the roof and above the first story of an apartment building not supported as above described in this section, shall be of the thickness prescribed for buildings of this class in Section 388 of this chapter.

Sec. 406. (Space Occupied on Lot.—Plat Measurements.)—No new tenement house, alone or with other buildings now or hereafter erected, shall occupy above the first story more than eighty-five per centum of the area of a corner lot or more than ninety per centum of the area of such corner lot, if such corner lot is bounded on three sides by streets or alleys, or more than seventy-five per centum of the area of any other lot, provided, that the space occupied by fire escapes, constructed and erected according to law and not more than four feet wide, shall be deemed unoccupied.

At the time of applying for a permit for the erection of a new tenement house the applicant shall submit a plat of the lot showing the dimensions of the same and the position to be occupied by the proposed building, and the position of any other building or buildings that may be on the lot. The measurements shall in all cases be taken at the top of the first story and shall not include any portion of any street or alley.

Sec. 407. (**Corner Lot Defined.—Frontages.—Triangular Lots.**)—By "corner lot" is meant a lot situated at the junction of two streets or of a street and public alley not less than sixteen feet in width. Any portion of the width of such lot distant more than fifty feet from such junction shall not be regarded as part of a corner lot, but shall be subject to the provisions of this chapter respecting other than corner lots.

Where, in corner lots, the two frontages are of unequal length, the lesser street frontage shall be taken as the width of the lot. Street frontage alone and not alley frontage shall be considered in determining such lesser frontage. No existing tenement house shall hereafter be enlarged or its lot be diminished or other buildings be placed on its lot, so that after such change a larger proportion of any corner lot or other lot upon which it is situated is covered by buildings than the aforesaid proportions, respectively; provided, however, that in case of a lot triangular or irregular in shape, bounded on two or more sides by a street and having a number of lineal feet street frontage *exceeding* one-twentieth of the number of square feet in the area of such lot, it shall not be necessary to comply with the conditions of this section as to percentage of lot to be covered; and provided, further, that there shall be no violation of Section 411 of this chapter in the erection of any tenement house.

Amended October 22, 1906, by the substitution of the word "exceeding" in lieu of the word "extending," in fourth line from bottom of section.

Sec. 408. (**Fire Walls.—When Dispensed With.**)—Fire walls of brick not less than twelve inches thick shall be built, extending above the roofs of all adjoining buildings, if such roofs are flat, and also where the building stands upon any line of any lot, excepting street or alley lines. Provided, that where eight-inch walls are permitted in the top story of buildings, or where the building is not over three stories high, the fire walls may be eight inches thick. Such fire walls, where they stand upon lot lines or where they are over the dividing walls between buildings or over the dividing walls in the interior of buildings, where such are called for by this chapter by reason of the great area of such buildings, shall extend at least two feet above the roofs of such buildings. Fire walls upon street and alley lines shall extend not less than eighteen inches above the roofs of such buildings. Fire walls may be dispensed with on street and alley lines, if the top of the roof boards and roof joists are protected against fire for a distance of at least five feet from such street or alley lines by a coating of mortar or hollow tile or porous tile at least two inches thick. Fire walls at street and alley lines may also be dispensed with in all cases where the entire framing and material of the roof shall be made strictly fireproof.

Walls facing upon courts and light shafts shall be treated as in the same category with walls facing upon streets and alleys.

Fire walls shall be covered with a weatherproof coping of incombustible material.

Sec. 409. (**Height.—How Measured.**)—The height of a new tenement house shall not by more than one-half exceed the platted width of the widest street on which it abuts.

Provided, however, that any distance the building sets back from the lot line shall be added to the width of the street in making this computation, but no existing tenement house shall be increased beyond such height. Such height shall be the perpendicular distance from the grade nearest the house to the highest point of the roof (not including as part of the roof any cornice or bulkhead less than eight feet high, or any elevator enclosure less than sixteen feet high). Where such street grade varies, the mean or average grade thereof opposite such house shall be the datum from which such height shall be measured.

Sec. 410. (**Alley or Yard in Rear.—Must Have.—Size of Yard Increased.**)—At the rear of every lot containing a new tenement house (unless the rear of such lot abuts upon a public alley at least ten feet wide) there shall be a yard open and unobstructed from the earth to the sky, except by fire escapes not more than four feet wide, constructed and erected according to law; every part of such yard shall be directly accessible from every other part thereof; such yard shall on corner lots (as above defined) have an area of at least eight per centum of the superficial area of the lot, and shall on other lots have an area of at least ten per centum of the superficial area of the lot. Every such yard shall be increased one per centum of the superficial area of the lot for every story above three stories in height of the tenement house situated thereon, and in no case shall such yard separate any building on such lot by less than ten feet from the rear line of the lot at the nearest point of approach of such building to such rear line.

For the purpose of construing and enforcing this section, the rear of the lot shall be held and deemed to be that part of the lot that is farthest from the line of the street upon which the proposed building will face, and in case where the proposed building will stand upon a corner lot or tract of land abutting upon two streets and an alley, in

In such cases the proposed building or buildings may extend from the front to the rear of such lot or tract. Nothing herein contained shall conflict with or modify any other provision of this ordinance.

As amended by ordinance January 8, 1906.

Sec. 411. (Requirements in Case of Enlarging.—Distance between Buildings.)—Amended by ordinance March 23, 1908, to read as follows:

No existing tenement house shall (unless the rear of the lot upon which it stands abuts upon a public alley at least ten feet wide) hereafter be enlarged or its lot line be diminished so that any building on such lot shall at any point approach nearer than ten feet to the rear line of the lot. Where a tenement house, now or hereafter, erected, stands upon a lot other than a corner lot, no other building shall hereafter be placed upon the front or rear of that lot, unless the minimum distance between such buildings be at least ten feet, neither building exceeds the height of one story; or fifteen feet if either building exceeds the height of one story, but not the height of two stories; and so on, five additional feet to be added to such minimum distance of ten feet for every story more than one in the height of the highest building on such lot: Provided, however, that where a fireproof passageway seven feet in height and five feet wide with fireproof doors not less than four feet wide leading from the street to the yard and properly lighted is constructed, connected with the yard, so that the lowest portion of said fireproof passageway shall not extend more than four feet below the level of the sidewalk grade, said fireproof passageway shall be taken and accepted in lieu of the ten feet required herein between the rear of said building and the rear line of the lot where the yard and court comply with the requirements of Section 410 of the Revised Municipal Code of Chicago of 1905, as amended January 8, 1906: Provided, however, in case such fireproof passageway is constructed, there shall be at least fifteen feet along the lot line a yard, and in no case shall such yard separate any building on such lot by less than ten feet from the rear line of the lot at the nearest point of approach of such building to the rear lot line, and that all parts of such yard shall be open and unobstructed from the earth to the sky, except by stairways or fire-escapes, and their necessary porches and landings which shall be constructed entirely of iron, concrete or incombustible material. And such fireproof passageways thus connecting with the yard shall only be permitted in connection with buildings or structures built on a corner lot facing upon two streets. Nothing herein contained shall conflict with or modify any other provision of this chapter.

Sec. 412. (Courts, Porches.)—Every court of every new tenement house shall be open and unobstructed at every point thereof from the bottom thereof to the sky, save by fire escapes or stairs or landings constructed and erected according to law and projecting not more than four feet into courts, which courts shall communicate directly without obstruction into a street, alley or yard. Where porches are constructed in courts, the amount of area of unobstructed space in such courts shall be exclusive of space occupied by stairs and porches. No rear porch shall be constructed which is more than eight feet in width where the construction is of combustible material, and no such rear porches shall be enclosed with other than incombustible material, as defined in Section 506 of this chapter.

Sec. 413. (Rooms—Habitable—Windows—Vent Shafts.)—Amended by ordinance Nov. 25, 1907, to read as follows:

In every new tenement house every habitable room, excepting water closet compartments and bath rooms, shall have all windows open direct upon a street, alley, yard or court. The total area of the windows opening from such room (other than water closet compartments and bath rooms) upon a street, alley, yard or court, shall be at least one-tenth of the floor area of that room, and the top of at least one window shall be not less than seven feet above the floor, and the upper half of that window shall be made so as to open its full width. No window in any such room (other than pantries, water closet compartments and bath rooms) shall have less than ten square feet glass area, and in no such water closet compartment or bath room shall the total window area be less than three square feet glass area, or the width of any window less than one foot; and when any window ventilating any water closet compartment or bath room in any new tenement house opens into a vent shaft, no window from any room other than a water closet compartment, bath room, pantry or hall shall open into such vent shaft.

Sec. 414. (Windows In Lot Line Walls.)—Windows in addition to those provided or in Section 413 of this chapter, if placed in any lot line wall or in any wall nearer to the lot line than is specified in Section 416 of this chapter from such lot line, then the sash in such window shall be stationary and glazed with fire-resisting glass.

Section 414 repealed in its entirety by ordinance of February 18, 1907 (page 3336, Council Proceedings).

Sec. 415. (Courts.—Inner.—Sizes Of.—Lot Line Courts.)—The "inner courts" of all new tenement houses as defined in Section 389 of this chapter shall have areas and minimum widths in all parts not less than the widths and areas as follows:

| Buildings. | Square Feet. | Least Width. |
|----------------|--------------|--------------|
| 2 stories..... | 100 | 6 feet |
| 3 stories..... | 120 | 7 feet |
| 4 stories..... | 160 | 8 feet |
| 5 stories..... | 250 | 12 feet |
| 6 stories..... | 400 | 16 feet |
| 7 stories..... | 625 | 20 feet |
| 8 stories..... | 840 | 24 feet |

"Lot line courts" shall have areas and minimum widths in all parts not less than one-half of those specified in the above table of "inner courts."

Sec. 416. (Courts.—Outer.—Sizes Of.—Width Increased.)—The "outer courts" of all tenement houses defined in Section 389 of this chapter shall have not less than the following widths for their minimum in all parts:

| Buildings. | Least Width. |
|----------------|--------------|
| 2 stories..... | 3 feet |
| 3 stories..... | 3 feet 6 in. |
| 4 stories..... | 4 feet |
| 5 stories..... | 6 feet |
| 6 stories..... | 8 feet |
| 7 stories..... | 10 feet |
| 8 stories..... | 12 feet |

If the outer or lot line court has windows on opposite sides of the same, the least widths given in the above table for outer courts shall be doubled.

Sec. 417. (Rooms.—Sizes and Height of.—Attic and Janitor's Rooms.)—In every new tenement house, all rooms, except water closet compartments and bath rooms, shall be of the following minimum sizes: In each apartment there shall be at least one room containing not less than one hundred and twenty square feet of floor area, and every other room shall contain at least seventy square feet of floor area. Each room shall be in every part not less than eight feet six inches high from the finished floor to the finished ceiling, but an attic room need be eight feet six inches high in but one-half of its area; provided, that in a basement apartment used for janitor's use only, such room or rooms shall be not less than eight feet high in the clear.

Sec. 418. (Rooms.—Changes in Existing.)—No room in any now existing tenement house shall hereafter be constructed, altered, converted or occupied for living purposes unless it contains a window having a superficial area not less than one-twelfth the floor area of the room, which window shall open upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet; or unless such room adjoins another room in the same apartment, which other room shall have such a window opening upon such a street, alley, yard or court, and between which two adjoining rooms there shall be a sash window having at least fifteen square feet of glazed surface, the upper half of which shall be so made as to open easily.

Sec. 419. (Windows.—Courts.—Attic.)—No room in any now existing tenement house which has no such window, as aforesaid, opening upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet, shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a floor area of at least sixty square feet and also at least six hundred cubic feet of air space; nor unless every part of the finished ceiling of such room be at least eight feet distant from every part of the finished floor thereof; provided, that an attic room need be eight feet high in but one-half of its area and such attic room shall not be used for purposes of human habitation other than as a sleeping room.

Sec. 420. (Air.—Quantity of for Each Person.)—No room in any tenement house shall be so occupied that the allowance of air to each person living or sleeping in such room shall at any time be less than four hundred cubic feet for each such person more than twelve years old, and two hundred cubic feet for each such person of the age of twelve years or under.

Sec. 421. (Alcoves.)

Amended by ordinance of February 18, 1907, to read as follows:

Alcove rooms must conform to all the requirements of other rooms, except that in one or two-story existing buildings which it may be desired to raise or alter, every alcove shall be deemed a separate room for all purposes within the meaning of this ordinance, except

such an alcove as, adjoining another room, has at least twenty per centum of entire wall surface of alcove opening to another room.

Sec. 422. (Light in Halls.—Recesses.—Returns.—Doors In.)—In every new tenement house every public hall shall be lighted by at least one window in each story opening directly upon a street, alley, yard or court, or by a skylight. Such window shall be so placed that light may pass directly through it and the hall to the opposite end of the hall, or else there shall be at least one window opening directly upon a street, alley, yard or court in every twenty feet in length or fraction thereof of every such hall, except in so much of any entrance hall as lies between the entrance and the flight of stairs nearest the entrance. In any such public hall, recesses or returns, the length of which do not exceed twice the width of the hall, will be permitted, without an additional window, but otherwise each recess or return shall be regarded for the purposes of this section as if it were a separate hall. Any part of a public hall which is shut off from any other part by a door or doors shall be deemed a separate public hall within the meaning of this section.

Sec. 423. (Public Halls.—Windows In.)—In every new tenement house one at least of the windows provided to light each public hall or part thereof shall have a glass area of at least twelve square feet.

Sec. 424. (Rooms and Halls.—Additional.)—Any additional room or hall that may hereafter be constructed or created in an existing tenement house shall comply in all respects with the provisions of this chapter as to size, arrangement, light and ventilation of rooms and halls.

Sec. 425. (Shafts.—Inner and Outer Vent.—Dimensions.)—Inner or outer vent shafts of all tenement houses as defined in Section 389 of this chapter shall be of the following dimensions:

| Building. | Square Feet. | Least Width. |
|----------------|-----------------|-----------------|
| 2 stories..... | 22½ | 3 feet |
| 3 stories..... | 27 | 3 feet |
| 4 stories..... | 36 | 3 feet |
| 5 stories..... | 48 | 5 feet |
| 6 stories..... | 72 | 6 feet |
| 7 stories..... | 96 | 8 feet |
| 8 stories..... | 120 | 8 feet |

Sec. 426. (Skylight Over Stairs.—Ventilating.—Area Of.)—In every new tenement house there shall be in the roof, directly over each stair well, a ventilating skylight, which shall have a glazed surface of the following dimensions: Where such tenement house shall not exceed two stories in height, and covering a superficial ground area of not to exceed sixteen hundred square feet, the glazed surface in such ventilating skylight shall be not less than fifteen square feet in area. For a three-story building, with a superficial ground area of not to exceed sixteen hundred square feet, the glazed surface of such ventilating skylight shall be not less than twenty square feet in area. For all buildings in excess of three stories and covering a superficial ground area in excess of 1,600 square feet, the glazed surface of such ventilating skylight shall be not less than twenty-five square feet in area; provided, however, that such ventilating skylights shall not be required in any of such buildings where the stairways are lighted by a window on each story landing.

If the building is more than three stories high, the skylights shall have at least six inches above same a strong wire netting (wire not lighter than No. 8 and a mesh not coarser than one and one-half by one and one-half inches) unless the glass contains a wire netting within itself.

Sec. 427. (Flues in Walls.)—In every new tenement house there shall be adequate flues in walls of masonry not less than forty-nine square inches area in each chimney running through every floor, with an open fireplace or grate or place for a stove, properly connected with one of such chimney flues, for every apartment, every additional flue used shall not be of less size than the above.

Sec. 428. (Cellar and Basement—Ceilings—Ventilation.)—Amended by ordinance Nov. 25, 1907, to read as follows:

All cellars and basements shall be ventilated at each end, and where boilers or furnaces are located the ceiling over the boiler or furnace, extending for two feet beyond boiler or furnace in each direction, shall be covered with metal lath and plastered, or any other incombustible material approved by the Commissioner of Buildings.

Sec. 429. (Damp-Proofing.—Basement Walls and Floors.)—Every new tenement house shall have all its outside walls below the adjacent ground level plastered on the outside with Portland cement or treated with other approved damp-proofing material, and such walls, as high as the ground level, shall be laid in cement mortar.

The basement or cellar shall have a floor of Portland cement concrete not less than three inches in thickness.

Sec. 430. (Cellar Changed for Living Purposes.—Requirements.—Height.)—In no now existing or new tenement house shall any room in the cellar be constructed, altered, converted or occupied for living purposes; and no room in the basement of a tenement house shall be constructed, altered, converted or occupied for living purposes, unless all of the following conditions of this chapter be complied with, and at least one-third of the height of the basement shall be above grade for building; provided, in each case it shall be at least four feet above the street grade. Such rooms shall be at least 8 feet 6 inches high in all now existing or new tenement houses in every part, from floor to the ceiling, except as provided for janitor's use only in Section 417 of this chapter.

Sec. 431. (Water Closet.)—There shall be appurtenant to such room or apartment, a water closet conforming to the regulations and ordinances of the city relating to water closets.

Sec. 432. (Shafts, Areas, Etc., to Extend Two Inches Below the Floor.—Graded.—Concreted.—Drained.)—In every new tenement house, the bottom of all shafts, courts and yards which extend to the basement and light and ventilate the living rooms in such basement shall, by means of areas, not less than two feet six inches in their least dimension or otherwise, be extended a distance of at least two inches below the floor level of the part intended to be occupied. All shafts, inner courts and areas which extend to the ground shall be properly concreted, and all shafts, inner and lot line courts and areas shall be properly graded and drained, and shall be so connected with a street sewer through an intermediate trap or surface basin (where such a sewer is adjacent to the lot), that all water may be drained freely into it.

Sec. 433. (Sinks.—Requirement.)—In every new tenement house there shall be in each apartment at least one proper sink with running water. In every now existing tenement house there shall be on every floor at least one proper sink with running water, accessible to all the tenants of that floor, without passing through any other apartment, if there be not one such sink in each apartment. In no tenement house shall there be woodwork inclosing sinks located in the public halls; the space underneath sinks shall be left entirely open.

Sec. 434. (Water Closets.—Access to.—Windows in.—Artificial Light.)—In every new tenement house there shall be a separate water closet in a separate compartment within each apartment, accessible to each apartment, without passing through any other apartment, provided that where there are apartments, consisting of only one or two rooms, there shall be at least one water closet for every two apartments. Every water closet compartment in every new tenement house shall have a window opening upon a street, alley, yard, court or vent shaft, and every water closet compartment in every existing tenement house shall be ventilated by such a window, or else by a proper ventilating pipe running through the roof. Every water closet compartment in every tenement house shall be provided with proper means of artificially lighting the same. If fixtures for gas or electricity are not provided in any such compartment, then the door thereof shall have ground glass or wire glass panels or transoms.

Sec. 435. (Sanitary Requirements.)—No drip trays shall be permitted in new tenement houses. All water closet fixtures in every new tenement house shall be constructed and set up comfortably to the requirements of the Department of Health. All privy vaults used in connection with any existing tenement house shall be replaced by water closets, constructed and set up in conformity with the provisions of this chapter, whenever connection with a public sewer is in any way practicable, and the Department of Health of the city shall be the sole judge as to the practicability of such connection with the public sewer. At least one such water closet shall be provided for every two apartments in each existing tenement house, and such water closets may be located in the yard if necessary. If so located, long hopper closets may be used, provided all traps, flush tanks and pipes be protected against frost.

Sec. 436. (Loads.—Allowance for Live Loads in Construction of Floors.)—For all buildings of Class VI. the floors shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of the floor construction, and including the weight of partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of forty pounds for every square foot of surface in such floors.

Sec. 437. (Pipes Through Floors.)—In every new tenement house where plumbing or other pipes pass through floors or partitions, the openings around such pipes shall be sealed or made air tight with plaster or other incombustible material, so as

to prevent the passage of air or the spread of fire from one floor to another or from room to room.

Sec. 438. (**Catch Basins.**)—The covers of all catch basins in lots containing tenement houses shall be of stone or iron, and shall be placed in courts or yards flush with the surface of such courts or yards, so that access to such basins may be convenient.

Sec. 439. (**Stairways.—Fire Escapes to be Free From Incumbrance.**)—No incumbrance of any kind shall at any time be placed before, upon or against any stairway, steps or landings or fire escapes in or upon any tenement house. All fire escapes upon tenement houses shall be kept in good order and repair, and every exposed part thereof shall at all times be protected against rust by durable paint.

Sec. 440. (**Water Closets.—Access To.**)—In every apartment of three or more rooms in every new tenement house convenient access from the outer door of the apartment to every living room and to every bedroom, and to every room used as a bedroom, and to at least one water closet compartment, shall be provided otherwise than through any bedroom or room used as a bedroom.

Sec. 441. (**Buildings Damaged by Fire, Etc.**)—If any existing tenement house is hereafter damaged by fire or other cause (including ordinary wear) so that at any time its value be less than one-half its original cost (exclusive of the value of the foundations) such building shall not be repaired or rebuilt except in conformity with the provisions of this chapter applicable to new tenement houses.

Sec. 442. (**Changes or Alterations.—Permits.**)—Every new tenement house and all changes or alterations in any existing tenement house shall conform to the requirements of this chapter. No new tenement house shall be begun, nor shall any changes or alterations in any existing tenement house, such as are referred to in this chapter, be begun until a permit therefor shall have been issued by the Building Department of the city. Such permit shall be issued only upon an application by the person for whom the building is to be erected or altered, and after approval of the plans and specifications of such tenement house, or such changes or alterations by the Health Department of the city whenever such approval is required by law or ordinance.

Sec. 443. (**Notice to be Sent to Commissioner of Buildings to Inspect.—Certificate to be Issued.—Notice to Inspect to be Filed.**)—It shall be the duty of the owner or his agent, when a tenement house is in course of erection, to notify the Commissioner of Buildings of the city when the building is or will be ready for lathing, and the Commissioner shall, within three days of the time specified, cause an inspection to be made, and if the construction is found to be in accordance with the requirements of this chapter he shall issue or cause to be issued a certificate to that effect; otherwise he shall cause the penalties provided in Section 445 of this chapter to be enforced. The Commissioner shall file for reference the notice received and shall also file a copy of the certificate in the office of the Building Department.

Sec. 444. (**Yards, Courts, Etc.—Must Comply as to.**)—Any tenement house not conforming in itself and in its yards, courts, areas and shafts to the requirements of this chapter shall not be occupied, or if found occupied shall forthwith be vacated upon notice from the Commissioner of Buildings, and such tenement house shall not again be occupied until made to conform in all respects with the provisions of this chapter, notwithstanding the issuance of a building permit for the erection or alteration of such building.

Sec. 445. (**Violations.—Penalty For.**)—Any owner, lessee, tenant, occupant or agent of any tenement house, or any architect, contractor, builder or foreman superintending or in charge of the work of construction of any tenement house violating, disobeying, neglecting or refusing to comply with or resisting the enforcement of any of the provisions of this chapter shall be fined not less than ten dollars nor more than two hundred dollars for each offense, and any violation of any provision of this chapter, if continued after the first fine is imposed, shall, for every week of such continuance, be punishable by an additional fine of not less than ten dollars nor more than two hundred dollars.

Sec. 446. (**Provisions of this Chapter not to Apply to Existing Buildings, Except Under Certain Circumstances.**)—Nothing in this chapter contained shall be considered as requiring alterations in the construction or equipment of buildings in existence at the time of the passage of this ordinance, and which at the time of their construction were built in compliance with the ordinances then in force, unless such building shall not have sufficient or adequate means of egress therefrom or ingress thereto by reason of insufficient or inadequate stairway or stairways improperly located or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress.

If, however, it is desired to enlarge or in any manner materially modify the construction of any existing building, or to make any change in its use or occupation which will transfer it from one class, as defined by this chapter, to another class, then before such enlargement or structural change or modification of building is made, or before such change in its use or occupation may be made, the entire building shall be reconstructed or modified in such manner as to bring the same, when enlarged or altered, or when occupied for its new and different purposes, into accordance with the provisions of this chapter.

Sec. 447. (Commissioner Shall Notify.)—Where it shall appear to the said Commissioner that any such building has inadequate or insufficient means of egress therefrom or ingress thereto, as aforesaid, he shall notify the owner, agent or person in possession, charge or control of such building, of such fact, and direct him forthwith to make such alterations and changes in the construction or equipment of such building as are necessary to be made in order to promote the safety of the occupants of such building and of persons using the same and of the public.

Sec. 448. (Where Conflicting with Other Sections.)—In cases of direct conflict with the provisions of other sections of this chapter relating to other classes, the provisions of the sections relating to Class VI. shall govern in respect to tenement houses.

ARTICLE X

PROVISIONS RELATING SOLELY TO CLASS VII.

In Class VII. shall be included all buildings used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as "department stores."

Sec. 449. (Buildings of Class VII.—Construction Of.)—Buildings used either wholly or in part for the purposes of Class VII. three stories or less in height may be of ordinary construction.

Such buildings more than three and not exceeding five stories in height shall be of slow-burning, mill or fireproof construction.

Such buildings over five stories in height shall be of fireproof construction.

Sec. 450. (Walls.—Thickness Of.)—The thickness of inclosing walls shall conform to the following requirements:

| | Basement. | STORIES | | | | | | | | | | | |
|--------------|-----------|---------|----|----|----|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| One-story | | 12 | 12 | | | | | | | | | | |
| Two-story | | 16 | 12 | 12 | | | | | | | | | |
| Three-story | | 16 | 16 | 12 | 12 | | | | | | | | |
| Four-story | | 20 | 20 | 16 | 16 | 12 | | | | | | | |
| Five-story | | 24 | 20 | 20 | 16 | 16 | 16 | | | | | | |
| Six-story | | 24 | 20 | 20 | 20 | 16 | 16 | 16 | | | | | |
| Seven-story | | 24 | 20 | 20 | 20 | 16 | 16 | 16 | 16 | | | | |
| Eight-story | | 24 | 24 | 24 | 20 | 20 | 16 | 16 | 16 | 16 | | | |
| Nine-story | | 28 | 24 | 24 | 24 | 20 | 20 | 16 | 16 | 16 | 16 | | |
| Ten-story | | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 16 | |
| Eleven-story | | 28 | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 | 16 |
| Twelve-story | | 32 | 28 | 28 | 28 | 24 | 24 | 24 | 20 | 20 | 20 | 16 | 16 |

Provided, however, in buildings of steel skeleton, fireproof construction thickness of walls shall be governed by Section 510 of this chapter.

Walls, Ledges, Etc.—See Section 588.

Walls Around Stairs, Elevators and Shafts.—See Section 588.

Walls Reinforced (Concrete).—See Section 554.

Sec. 451. (Stories Used for the Retail Sale of Goods.—Occupation of Basement.—Lockers.)—Not more than the lower twelve stories above the street grade shall be used for the retail sale of goods, or for employees' locker rooms or for manufacturing purposes in a building devoted wholly or in part to purposes of Class VII., provided, however, the stories above the twelfth story may be used for these or other purposes when the stairs are built as described in Section 457 of this chapter.

Not more than one floor of any basement or cellar shall be used for the retail sale of goods. Such floor shall be the floor nearest to the inside street grade. Such floor used for the retail sale of goods shall not be more than twenty feet below the inside street grade.

No sub-basement, cellar or part of a basement below such floor shall be used for the sale of any goods in any manner, but locker and dressing rooms may be placed in the sub-basement, provided the space thus occupied be separated from the remainder of the basement by fireproof partitions, and that there be at least two flights of stairs placed as far apart as practicable leading therefrom to the

first floor inclosed in fireproof partitions as provided in Sections 533 and 534 of this chapter. Such stairs from such locker or dressing rooms shall be in addition to other stairways required by this chapter in such building, provided that at least one of such stairways shall open directly on a street, alley or court opening on a street or alley or a fireproof passage leading to the street, alley or such court. Where more than five lockers are in one room such lockers shall be of incombustible material.

Sec. 452. (**Floor Areas.—Maximum.**)—The floor area of any one story or portion of a story used for the purposes of Class VII. of any building of ordinary construction shall not exceed nine thousand square feet.

The floor area of any one story or portion of a story used for the purposes of Class VII. of any building of slow-burning or mill construction shall not exceed twelve thousand square feet.

The floor area of any one story or a portion of a story used for the purposes of Class VII. of any building of fireproof construction shall not exceed 25,000 square feet.

Sec. 453. (**Floor Areas.—Exceeding the Maximum Limits Defined in Section 452.**)—Where any floor or portion of a floor used for the purposes of Class VII. in any building shall exceed in area the maximum number of square feet allowed in the preceding section for the type of construction of such building in which such floor is contained, each such maximum amount of floor area so used shall be separated from other parts of such floor by fire walls or dividing walls built in accordance with the provisions of Section 259 of this chapter relating to dividing walls in buildings of Class I.

Where any such floor so used is divided by such fire walls or dividing walls, each such division of such floor shall be provided with stairs, aisles, exits and fire escapes, as is required in this chapter for separate and distinct buildings, and each such division shall be considered as a separate building.

Sec. 454. (**Galleries.**)—The area of any one or all of the galleries, mezzanine or intermediate floors in any one story used wholly or in part for the purposes of Class VII. in any building shall not exceed 10 per centum of the area of such story, and galleries, mezzanine or intermediate floors of a larger size than the above shall be considered as full stories.

Every gallery, mezzanine or intermediate floor shall have at least one stairway not less than three feet wide.

The height from the floor of any gallery, mezzanine or intermediate floor to the ceiling over same shall not be less than seven feet, and there shall be not less than seven feet space between the bottom of such gallery, mezzanine or intermediate floor, and the floor of the story in which such gallery, mezzanine or intermediate floor is placed.

Every gallery, intermediate or mezzanine floor used for the purposes of Class VII. in any building shall be built entirely of fireproof or incombustible construction with the exception of the floor surface and nailing strips, which may be of wood.

No gallery, intermediate or mezzanine floor shall be built without a permit from the Department of Buildings, and plans showing the construction and size of such proposed gallery, intermediate or mezzanine floor shall be filed with the Department of Buildings when a permit is applied for.

Sec. 455. (**Courts of Class VII. Buildings.**)—Every court or light shaft of every building used wholly or in part for the purposes of Class VII. shall be open and unobstructed from the floor of such court to the sky, with the exception that fire escapes may be built therein, and such court shall have walls constructed in the same manner as is required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

All windows, doors or other openings in court walls of such buildings shall have metal frames, metal sashes and metal doors, with the glazed portion thereof of fire-resisting glass.

Sec. 456. (**Stories.—Numbering Of.**)—The first story above the inside street grade shall be designated and known as the first story for all purposes of this chapter, and the stories above shall be numbered, consecutively, the second, third, and so on.

Sec. 457. (**Stairways.—Interior Stairways in Buildings of Class VII.**)—Buildings used wholly or in part for purposes of Class VII. shall have two stairways if the aggregate floor area is five thousand square feet or less, three stairways if the aggregate floor area is more than five thousand square feet and not more than ten thousand square feet, and four stairways if the floor area is more than ten thousand square feet.

The number of stairways and the aggregate width of stairways required for the various floor areas shall be as indicated in the table hereinafter set forth in the following section.

The width of the different stairways need not be alike, and for each four stories, or fractional number of stories, of the building above the first four stories, each stairway may be reduced by six inches, as set forth in the table of stairs in Section 58, but no stair in a Class VII. building shall be of a less width than three feet.

Stairways in buildings used wholly or in part for the purposes of Class VII. shall be located as far apart as practicable, and shall have hand rails on each side thereof, and no such stairway shall be a spiral stairway or have any winders. The height of the individual riser shall not exceed seven and three-eighths inches. The width of the individual tread shall be not less than ten inches. Stairways which are over seven feet wide shall have double intermediate hand rails with end newel posts at least five and one-half feet high.

The bottom of each stairway shall be in the immediate vicinity of the top of the stairs leading to the next lower story, and the line of travel from stairway to stairway shall be direct and easily accessible each to the other.

Every story below street grade shall have not less than two stairways to the first story and each such stairway shall be not less than three feet wide, but where basement or a cellar is used for the retail sale of goods the stairways from such basement or cellar shall be in number and aggregate width as indicated in the table of stairways set forth in the following section for the lower four stories of the same building.

The whole number of stairways required for any such building shall be complete in every respect from the first floor to the topmost floor, and each stairway shall be extended to the roof.

Provided, however, that if any building used wholly or in part for the purposes of Class VII., be equipped with automatic sprinklers, and be connected with another building similarly used, and distant not less than twenty-five feet, and used by the same occupant, by a fireproof bridge or passageway similarly equipped, then each such bridge or passageway shall be held to be equivalent to and take the place of one outside stairway fire escape on each of the buildings so connected.

As amended by ordinance, October 29, 1906.

Sec. 458. TABLE OF STAIRWAYS FOR CLASS VII. BUILDINGS.
AGGREGATE WIDTH OF STAIRWAYS.

| SQUARE FEET OF | | | | | |
|-------------------------|----------------------|------------------------|---------------------------|----------------------------|-------------|
| Building | 1st, 2d, 3d, 4th, | 5th, 6th, 7th, 8th, | 9th, 10th, 11th, 12th, | 13th, 14th, 15th, 16th. | |
| Area. Story or Stories. | Story or Stories. | Story or Stories. | Story or Stories. | Story or Stories. | |
| 25,000 | 30 feet | 27 feet | 24 feet | 21 feet | 6 stairways |
| 20,000 | 25 feet | 22 ft. 6 in. | 20 feet | 17 ft. 6 in. | 5 stairways |
| 15,000 | 20 feet | 18 feet | 16 feet | 14 feet | 4 stairways |
| 14,000 | 19 feet | 17 feet | 15 feet | 13 feet | 4 stairways |
| 13,000 | 18 feet | 16 feet | 14 feet | 12 feet | 4 stairways |
| 12,000 | 17 feet | 15 feet | 13 feet | 12 feet | 4 stairways |
| 11,000 | 16 feet | 14 feet | 12 feet | 12 feet | 4 stairways |
| 10,000 | 15 feet | 13 ft. 6 in. | 12 feet | 10 ft. 6 in. | 3 stairways |
| 9,000 | 14 feet | 12 ft. 6 in. | 11 feet | 9 ft. 6 in. | 3 stairways |
| 8,000 | 13 feet | 11 ft. 6 in. | 10 feet | 9 feet | 3 stairways |
| 7,000 | 12 feet | 10 ft. 6 in. | 9 feet | 9 feet | 3 stairways |
| 6,000 | 11 feet | 9 ft. 6 in. | 9 feet | 9 feet | 3 stairways |
| 5,000 | 10 feet | 9 feet | 8 feet | 7 feet | 2 stairways |
| 4,000 | 9 feet | 8 feet | 7 feet | 6 feet | 2 stairways |
| 3,000 | 8 feet | 7 feet | 6 feet | 6 feet | 2 stairways |
| 2,000 and less | 7 feet | 6 feet | 6 feet | 6 feet | 2 stairways |

Whenever any building of fireproof construction used wholly or in part for the purposes of Class VII., shall adjoin or be attached to a fireproof building, used by the same occupant, and having in its required intervening fire wall one or more openings, fitted with fire doors, on each side of the fire wall, having self-closing device thereon, as approved by the Building Department, then every such opening shall, for all purposes, be held to be equivalent to and take the place of and be regarded as a stairway, built and enclosed in the manner described in the following section (459). But in no case shall there be less than one stairway in any such building.

As amended by ordinance, October 29, 1906.

Sec. 459. (Stairs.—Fireproof Interior.)—Where an interior stairway and its stair hall of a building used wholly or in part for the purposes of Class VII. are inclosed in all stories of the building by fireproof partitions built as described in Section 533 of this chapter for fireproof construction, and where the stairways and landings are built as described in Section 534 of this chapter for fireproof construction, and where the doors, frames, sashes and casings and the glazed portions thereof are

built as described in Section 525 of this chapter for fireproof construction, then such stairway, if not less than five feet in width from first floor to the topmost floor, shall be considered as the equivalent of two open stairways, but in no case shall there be less than two stairways in any such building.

Sec. 460. (**Stories.—Where Stories Above Twelfth Are Used for Class VII. Purposes.**)—Where stories above the twelfth story are used for the purposes of Class VII, as hereinbefore described for employees' locker rooms, then the stairways from the first to the topmost floor shall be built and inclosed as described in the preceding section, but the stairways shall be in number and in their aggregate width as required in the table of stairways set forth in Section 458 of this chapter.

Sec. 461. (**Stairs.—Halls.—Passageways and Aisles.—Signs and Lights.**)—The stair halls, passageways or stair aisles shall be unobstructed and shall be as wide as the stairs, and not less than four feet wide in any place in the clear.

The exit door or doors between floors and stair halls shall be as wide as the stairway to which they afford access, and for each elevator opening into such a stair hall the doors to floors shall be increased to two feet in width.

The stairways and stair halls of any building used wholly or in part for the purposes of Class VII, shall be illuminated by gas or electric light, and the gas piping and the electric wiring shall be accomplished by piping and circuits separated and distinct from the general illuminating piping and circuits of the premises. Each stair light shall have a red glass inclosure.

At the bottom of each such stairway there shall be an illuminating red glass sign with the number of the story in which it is situated inscribed thereon in letters not less than six inches high.

Sec. 462. (**Aisles in Class VII. Buildings.**)—In buildings used wholly or in part for the purposes of Class VII, there shall be aisles in such portions of the building as are used for such purposes, connecting the stairways and the elevators directly with the street or alley doors, and such aisles shall be termed "main aisles." Such main aisles shall have a clear width equal to the width of the stairways connecting therewith, and for each elevator connecting with such an aisle there shall be an additional width of six inches, and no such main aisle shall be less than five feet wide in the clear between the counters in any department store or between the fixed seats therein. One-third the width of any basement stairway shall be added to the width of the main aisle connecting with such stairway.

If there is a column in any such aisle, then the width of the aisle shall be increased by the width of such column.

If there is a counter or counters or settee, or any case or other obstruction, in an aisle, then that part of the aisle on each side of such counter, settee or case or other obstruction shall be considered as a separate aisle. No aisle other than a main aisle shall be less than three feet in width.

Sec. 463. (**Exit Signs and Lights.**)—All exits in buildings used wholly or in part for the purposes of Class VII, shall be clearly indicated by illuminated red signs with the word "EXIT" thereon in letters not less than six inches high. At the bottom of each stairway on the street level floor there shall be similar signs indicating the direction of the nearest exit to a street or alley.

Fire escape doors or windows shall be indicated by illuminated red signs with the words "FIRE ESCAPE" thereon in letters not less than six inches high.

Sec. 464. (**Doors at Street Level.—Revolving Doors.**)—The clear width of the exit openings shall be computed in the same manner as that provided in this article for main aisles, and no door openings shall be less than five feet wide, and all doors shall swing outward. Revolving doors shall not be considered as exits, unless the revolving wings of said revolving doors are so arranged that by the application of a force slightly more than necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said doors fold flat on each other and in an outward direction, and unless each side, or the half circles of such revolving doors, are hinged and fastened so as to likewise swing backwards on application of force slightly beyond the normal, and which will permit of exit space for two ordinary persons on either side of the collapsed wings of said revolving doors and their inclosing half circles.

As amended by ordinance March 30, 1906, by addition of the part in italics.

Sec. 465. (**Doors in Dividing Walls.**)—Door openings may be built in dividing walls of such buildings, provided, however, that such door openings shall be provided with fireproof doors built as described in Section 260 of this chapter, and that each door shall have an efficient closing device, automatic in operation in the event of a fire, in close proximity to such door and on each side of such opening.

Each such opening shall have exit signs and lights as provided for street doors and exits in Section 463 of this chapter. There shall be aisles not less than

ive feet in width connecting with such doors from the main aisles, and in no case shall any such door be of less width than the aisle directly connecting therewith.

Doors and Windows.—When Required to Be Closed.—Fire Resisting Glass.—
See Section 632.

Sec. 466. (Floors.—Strength Of.—Allowance for Live Loads.)—Every structural part of every building used wholly or in part for the purposes of Class VII, shall safely support, in addition to the weight of floor construction, partitions and permanent mechanisms that may be set upon the same, a live load of not less than one hundred pounds per square foot of floor area, and the construction shall be calculated according to the safe unit stresses elsewhere defined in this chapter. Every part of any such building which is subjected to a live load of more than one hundred pounds per square foot of floor shall be of sufficient strength in the parts which support such load to safely support the load imposed, calculated according to the safe allowable unit stresses elsewhere defined in this chapter.

Sec. 467. (Fire Escapes in Class VII. Buildings.)—Every such building more than two stories in height shall have two stairway fire escapes. Such stairway fire escapes shall each be not less than thirty-six inches wide between centers of hand rails. Such stairway fire escapes shall be at opposite ends of the building or as far apart from each other as practicable.

Sec. 468. (Passageways.—Fireproof.)—Where stairway fire escapes do not extend to the ground level they shall have a counterbalanced stairway to the ground from a platform not more than twenty feet above the ground level.

Fire escapes in inclosed courts shall have open, unobstructed fireproof passageways leading directly to a street or an alley.

Sec. 469. (Fire Escapes.—Windows and Railings On.—Doors Opening On.)—All windows and doors which are passed by a fire escape of any kind, and all windows and doors opening on fire escape platforms or landing shall have fireproof frames glazed with fire-resisting glass.

Each fire escape platform shall have at least one window on each floor in any such building opening thereon.

Each such window shall be indicated by signs and lights as required in Section 63 of this chapter for exits.

Where window sills at fire escape exits are more than two feet above the floor, one or more steps not less than three feet wide shall be provided, with risers not to exceed twelve inches high and treads not less than eight inches wide.

The railings on stairway fire escapes and the railings around fire escape platforms shall have iron guards in addition to the iron hand rails; such guards shall be not less than four feet high measuring from the outer corner of the tread or from the platform; such guards shall have a mesh or openings not over two and one-half inches square, and the metal strands in such guards shall have a cross section of not less than one-eighth of an inch in diameter.

Sec. 470 (Fire Drill of Employees.)—It shall be the duty of every person or corporation maintaining or in possession, charge or control of any building used wholly or in part for the purposes of Class VII, to designate certain adult male employees in such building (the number of which employees shall be prescribed by the Fire Marshal), who shall be regularly and throughout the entire time such building is open to the public employed in such building, and who shall be physically and mentally able to perform the duties which shall be required of them in case of fire occurring in any such building. Such employees shall at least once in each month, when directed by the Fire Marshal or any authorized member of the Fire Department, take part in a fire drill conducted by the Fire Marshal, or any authorized member of the Fire Department, in the use of all apparatus for the prevention and extinguishing of fire in such building, whenever the Fire Marshal shall deem such drill necessary or advisable. Such person or corporation shall pay to the city the proportion of the regular salary of any employee of the Fire Department who shall be employed in drilling and examining the employees of any such building, based upon the time of such employment, and the Fire Marshal shall render bills monthly for such services.

Sec. 471. (Standpipes—Pumps—Axes, Etc.)—Amended by ordinance of July 8, 1907, to read as follows (Superseding amendatory ordinance of March 19, 1906):

(1) In every building over one hundred (100) feet in height not provided with a three (3) inch or larger inside standpipe, in all buildings hereafter constructed of a greater height than seventy-five (75) feet (except buildings used for theater purposes, as herein elsewhere provided for); in all buildings used for hospital purposes of a greater height than three (3) stories, with accommodations for at least twenty (20) patients; and in all buildings of a greater height than five (5) stories now or hereafter used for hotel or public lodging house purposes there shall be constructed one (1) or more four (4)

inch standpipes, which shall extend from basement to roof and which shall be connected at street or alley side of building with two-way Siamese connection for use of Fire Department, and which shall be provided with one hose connection, with Fire Department thread, on the roof of said building, on each floor and in the basement thereof, with sufficient hose attached to reach any point thereof. The pattern, quality, installation and maintenance of such standpipe, hose and couplings, shall be subject to the approval of the Fire Marshal.

(2) In any of the buildings herein referred to where approved sprinkler systems are installed and properly maintained, it shall not be necessary to install additional inside standpipe as above provided for.

(3) On each floor and in the basement of every building used for hotel, public lodging, or school purposes, three or more stories in height, there shall be two (2) or more portable hand pumps or chemical extinguishers, one or more fire axes and one or more pike poles. In the basement or janitor quarters of all apartment buildings three or more stories in height, the floors of which are divided into two or more apartments, and in the basement of all office buildings four or more stories in height there shall be provided one or more portable hand pumps or chemical extinguishers, one or more fire axes and one or more pike poles; all of which shall be installed and maintained subject to the approval and supervision of the Fire Marshal.

(4) The interior of all grain elevators and malt houses of a height of fifty (50) or more feet, which are not entirely fireproof, and which have a capacity of two hundred and fifty thousand (250,000) bushels or over, and the interior of all cold storage houses of a height of four (4) or more stories, which are not entirely fireproof and which have a ground floor area of ten thousand (10,000) or more square feet, shall be equipped with either a dry or wet sprinkler system, to each of which systems there shall be a feeder or riser pipe or pipes not less than four (4) inches in diameter, leading from one or more Siamese steamer connections; all of which shall be installed and maintained subject to the approval of the Fire Marshal.

(5) Grain elevators which are equipped with Journal Fire Alarm Systems of the most approved pattern and which are left at all times in the most perfect working order, or grain elevators, malt houses and cold storage houses, which are now equipped with standpipes, of approved pattern and hose with not less than two (2) inch connections which have been installed in accordance with City ordinances and approved by the Fire Department, each floor of which is approved by said department as being at all times easily accessible to firemen, where fire extinguishers, water barrels and pails are distributed at intervals on all floors on advice and instruction of the Chicago Underwriters' Association; where the necessary pump pressure is maintained; where some approved electric watch service and fire alarm system is maintained and watchmen are employed during nights, Sundays and holidays, pulling such stations not less frequently than once per hour, and which have outside Siamese connections and standpipes not less than two and one-half (2½) inches, shall be exempt from the provisions of this ordinance.

ARTICLE XI.

PROVISIONS RELATING SOLELY TO CLASS VIII.

In Class VIII. shall be included every building used exclusively for school purposes.

Sec. 472. (**Buildings of Class VIII.—Construction Of.**)—All buildings used wholly for the purposes of Class VIII. hereafter erected shall be constructed in accordance with the provisions of this chapter relating to Class VIII. as follows, viz.:

Such buildings having a seating capacity of less than four hundred, or which are not over two stories and basement in height, may be built of ordinary construction.

Such buildings having a greater seating capacity than four hundred and less than eight hundred, or which are not over three stories and basement in height, shall be built of slow burning or fireproof construction.

Such buildings having a greater seating capacity than eight hundred, and which are more than three stories and basement in height, shall be built entirely of fireproof construction.

New additions to existing buildings may be built: provided, however, that such new additions shall comply with the above requirements.

All alterations in existing buildings used wholly for the purposes of Class VIII., other than new additions thereto, intended to make them comply with the requirements of this chapter, may be executed in the same kinds of materials of construction at present employed in such buildings, unless otherwise distinctly provided herein.

Sec. 473. (**Frame Buildings.—Portable.**)—Portable frame buildings used wholly for the purposes of Class VIII., not larger than twenty-eight feet by thirty-six feet, and not over one story high, may be erected, provided the exterior walls and roof of same are covered with metal or incombustible material, and the interior wood-

work painted with fireproof paint, approved by the Commissioner of Buildings, and provided, further, that the location of such buildings shall be approved by the Commissioner of Buildings. Such portable buildings shall not be located nearer than ten feet to any other building, and shall not be maintained on any one lot or block for a longer period than two years after the date of the issuance of the permit therefor without a new permit from the Commissioner of Buildings.

Doors and Windows.—(When Required to Be Closed.—Fire-Resisting Glass.)— See Section 632.

Sec. 474. (Walls.—Window Openings In.)—No wall of any building used wholly or the purposes of Class VIII. containing a window opening shall be nearer than two feet to any lot line of adjoining property (street and alley lines not included).

Sec. 475. (Walls.—Thickness Of.)—The following regulations shall govern the construction of buildings used wholly for the purposes of Class VIII.:

The thickness of surrounding walls and of all dividing walls carrying the load of floors or roof shall be as indicated in the following table, to-wit:

(Walls Around Stairs, Elevators and Shafts.—See Section 588.)

| | —STORIES— | | | | | |
|---------------------|-----------|-----|-----|-----|-----|-----|
| | Basement. | 1 | 2 | 3 | 4 | 5 |
| | in. | in. | in. | in. | in. | in. |
| one story | | 16 | 12 | | | |
| two stories | | 16 | 16 | 12 | | |
| three stories | | 16 | 16 | 16 | 12 | |
| four stories | | 20 | 20 | 16 | 16 | 12 |
| five stories | | 24 | 20 | 20 | 16 | 16 |

Buildings built of fireproof construction shall be excepted from the foregoing provisions of this section, but shall comply with the other provisions of this chapter governing such buildings.

Sec. 476. (Loads.—Live.)—The floors of buildings used wholly for the purposes of Class VIII. shall be designed and constructed so as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon same, a live load of seventy-five pounds per square foot.

Sec. 477. (Stories.—Height Of.)—No story above the basement shall be less than twelve feet in height in the clear.

Sec. 478. (Floor Levels in Buildings of Fireproof Construction.)—The following limitations of floor levels of auditoriums or assembly halls of such buildings shall be observed in all cases:

In buildings of fireproof construction.

Not to exceed two thousand seating capacity, not over ten feet above sidewalk level.

Not to exceed one thousand seating capacity, not over thirty feet above sidewalk level.

Not to exceed eight hundred seating capacity, not over fifty feet above sidewalk level.

Not to exceed five hundred seating capacity, in any story; provided, however, that there shall be at least two separate and distinct stairways from the floor in which such auditorium or assembly hall is located to the ground, each of which shall not be less than four feet wide in the clear.

Sec. 479. (Floor Levels.—In Buildings Having Stairs and Corridors of Fireproof Construction.)

Not to exceed one thousand five hundred seating capacity, not over ten feet above sidewalk level.

Not to exceed one thousand seating capacity, not over twenty-five feet above sidewalk level.

Not to exceed eight hundred seating capacity, not over forty-two feet above sidewalk level.

Not to exceed five hundred seating capacity, not over fifty feet above sidewalk level.

Not to exceed two hundred and fifty seating capacity, not over sixty feet above sidewalk level.

Sec. 480. (Floor Levels in Buildings of Mill, Slow-Burning or Ordinary Construction.)

Not to exceed one thousand seating capacity, not over ten feet above sidewalk level.

Not to exceed six hundred and fifty seating capacity, not over thirty feet above sidewalk level.

Not to exceed five hundred seating capacity, not over forty-five feet above sidewalk level.

Not to exceed two hundred seating capacity, not over sixty feet above sidewalk level.

Sec. 481. (**Floors.—Height Of, Measured from Sidewalk Level.**)—Heights shall be measured from sidewalk level at entrance of buildings to highest part of main floor of auditorium or assembly hall.

Sec. 482. (**Stairways.—Width Of.**)—Stairways in buildings used wholly for the purposes of Class VIII. shall be in width equivalent to fifteen inches for every hundred of seating capacity in such building, as measured by the aggregate seating capacity of the auditorium, assembly rooms and school rooms; provided, however, that the number of persons allowed in such buildings at any one time shall be limited by the width of stairways available as exits therefrom.

No stairway shall be less than four feet in the clear, except where more than two stairways lead down from any floor, in which case stairways three feet wide in the clear may be counted in the total width of stairways required.

Where two or more stairways are used, they shall be placed at opposite ends of the building, or as far apart as practicable, and all such buildings hereafter erected shall have at least two separate and distinct stairways from the ground floor to the top floor, and all existing buildings shall have two such separate and distinct stairways, or one stairway and one stair or sliding fire escape.

Sec. 483. (**Stairways.—Railings on Each Side.—Height of Landing.**)—All stairways shall have railings on each side thereof. No stairway shall ascend a greater height than thirteen feet six inches without a level landing, which, if its width is in the direction of the run of the stairs, shall be not less than four feet wide, or which, if at a turn of the stairs, shall be of not less width than the stairs, and no winder shall be permitted in any stairs.

Sec. 484. (**Stairways.—Fireproof.**)—In such buildings hereafter erected more than two stories and basement in height, the stairways and their enclosing walls shall be of fireproof construction.

Sec. 485. (**Corridors, Passageways, Hallways and Doors.—Width Of.**)—The width of corridors, passageways, hallways and doors shall be computed in the same manner as that herein provided for stairways; provided, however, that no corridor shall be anywhere less than five feet in width, and no door less than three feet in width, except where two or more doors, each two feet four inches or more in width, are grouped together.

Sec. 486. (**Doors to Open Outward.**)—All doors in such buildings shall open outward, and all entrance and exit doors shall be unlocked at all times when the building is occupied for school purposes, or open to the public.

Sec. 487. (**Doors.—Exits Covered with Metal.**)—All exit doors from assembly halls and class rooms to other parts of the building shall be covered with metal or other fireproof material, approved by the commissioner of buildings.

Sec. 488. (**Aisles.—Width Of.—Number of Seats in Auditorium.**)—Aisles in auditoriums and assembly halls in such buildings shall be in width equivalent to eighteen inches for every one hundred of seating capacity in such auditorium or assembly hall, but no such aisle shall be less than two feet six inches wide in its narrowest part. All groups of seats shall be so arranged that they shall have an aisle on each side, and not more than twelve seats in any one row shall be placed between aisles.

Sec. 489. (**Aisles in Class and Recitation Rooms**)—Aisles in class rooms, recitation rooms and study rooms of such buildings shall be in width equivalent to eighteen inches for every one hundred permanent seats in any such room, but no main or cross aisle shall be less than two feet six inches wide in its narrowest part.

Sec. 490. (**Aisles and Passageways.—Kept Clear of Obstructions.**)—All aisles and passageways in such buildings shall be kept free from camp stools, chairs, sofas and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles or passageways during any performance, service, exhibition, lecture, concert or any public assembly, nor shall there be any chairs, settees or camp stools in such aisles or corridors at such times or occasions.

Sec. 491. (**Emergency Exits for Auditoriums or Assembly Rooms.—Aggregate Width Of.**)—All auditoriums or assembly halls of such buildings having a seating capacity of eight hundred or more shall be provided with emergency exits. The aggregate width of such emergency exits which shall be provided for each floor, balcony or gallery of such auditorium or assembly hall shall be one-half of the width of the main exit. No emergency exit or stairway shall be less than three feet in width.

Sec. 492. (**Exits.—Signs.**)—All exits opening from auditoriums and assembly halls of such buildings shall have the word "EXIT," in letters at least six inches high, applied to the auditorium side of every such exit, and when such auditorium or assembly hall is used at night, a red light shall be kept burning over the word "EXIT" during the entire time such building is so used and until the pupils or audience have left the building.

Sec. 493. (**Lights in Buildings.**)—Every portion of any such building devoted to the uses or accommodation of the public and all outlets therefrom leading to the streets, including the open courts and corridors, stairways and exits, shall be well and properly lighted during the entire time such portion is in use, and shall remain lighted until all the pupils or the audience have left the premises. All gas or electric lights in the halls, corridors, lobbies, stairs and exits leading from the auditorium or assembly halls shall be controlled by a separate shut-off and shall be independent of all other lights in such building.

Sec. 494. (**Windows.**)—The total glass area of outside windows and skylights of each class room, recitation room or study room in such buildings shall be not less than one-ninth of the floor area of such room.

Sec. 495. (**Basement.**)—In every such building in which the lower or basement door is below the surface of the ground surrounding such building, and is used in part or as a whole for heating or ventilating apparatus, such floor shall be considered the basement story of such building. Permanent class rooms in basements shall not be permitted.

Sec. 496. (**Fire Escapes.**)—Every building used for the purposes of Class VIII, of four or more stories in height shall be provided and equipped with one or more stairways or sliding fire escapes in such locations and numbers as shall be satisfactory to the Commissioner of Buildings.

Sec. 497. (**Fire Escapes to Be Examined.**)—It shall be the duty of the janitor of every such building, or such other employe or employes thereof as may be directed by the principal of such school to examine all fire escapes of such buildings from the topmost story to the ground, and to examine and operate all doors, windows and platforms leading to and from such fire escapes; and such inspection shall be made at least once each and every week that such building is used for school purposes, and a written report made of such inspection to the principal of such school, showing the time it was made and the condition of the fire escapes.

Such fire escapes shall be kept in good condition ready for immediate use at any and all times that such building is in use, and shall be kept free of snow and ice.

Sec. 498. (**Fire Drill.**)—The principal or other person in charge of the pupils in every such building shall establish and maintain a good and efficient fire drill, which shall be practiced at least twice every month during the time such building is used for school purposes.

A record shall be kept by the principal or other person in charge of the pupils of each fire drill held and of the time that elapses from the first fire signal until the last person is out of the building.

(**Walls.—Around Stairs, Elevators and Shafts.**)—See Section 588.

ARTICLE XII.

GENERAL PROVISIONS.

Fireproof Construction.

Sec. 499. (**Fireproof Construction.**)—In cases in which it is claimed that any equally good or more desirable mode or manner of construction, or material, or device for fireproofing, other than specified in this chapter, can be used in the erection or alteration of buildings, the Commissioner of Buildings, upon written application to him for a permit to use the same, shall have power to appoint a Board of Examiners, consisting of not less than three nor more than five members, each of whom shall have had at least ten years' experience in Chicago as an architect, engineer or builder, who shall take the usual oath of office. The said examiners shall adopt rules and specifications for examining and testing such mode or manner of construction, or material or device for fireproofing, and furnish a copy of the same to the applicant. And such specification shall provide for a comparative fire test of not less than four hours and for a period of at least two hours an average temperature of 2,000 degrees Fahrenheit shall be maintained. At the end of this test water shall be applied to the construction through a 1 1/8-inch nozzle under 60 pounds pressure for five minutes. Hollow tile shall be used as a basis for comparison, and if the proposed material shall pass said test as well or better than hollow tile, it shall be approved as a fireproofing material. The said examiners shall thereupon notify such applicant to submit to such examination and make such tests in the presence

of the said examiners, or a majority thereof, according to such rules and specifications. All expenses of such examiners, and of such examinations and tests, shall be paid by the applicant, and said examiners may require security therefor.

The said examiners shall, after such examination and tests, certify the results and their decision on the said application to the Commissioner of Buildings, who shall have power, in the event of the examination and tests being satisfactory, to grant a permit to the applicant in accordance with such decision of the said Board of Examiners.

A complete record of the proceedings and all acts and decisions of the said Board of Examiners shall be kept by the Commissioner of Buildings in his office.

The Commissioner of Buildings shall have the power to pass upon any question relative to the mode or manner of construction or materials to be used for fire-proofing in the erection or alteration of any building or structure to make the same conform to the true intent and meaning of the several provisions of this chapter.

Sec. 500. (Fireproof Construction.—Definition Of.)—The term fireproof construction shall apply to all buildings in which all parts that carry weights or resist strains, and also all exterior walls and all interior walls and all interior partitions and all stairways and all elevator enclosures are made entirely of incombustible material, and in which all metallic structural members are protected against the effects of fire by coverings of a material which shall be entirely incombustible, and a slow heat conductor, and hereinafter termed "fireproof material." Reinforced concrete as defined in this ordinance shall be considered fireproof construction.

Sec. 501. (Fireproof Material.)—The materials which shall be considered as filling the conditions of fireproof covering are: First, burnt brick; second, tiles of burnt clay; third, approved cement concrete; fourth, terra cotta; fifth, approved cinder concrete.

Sec. 502. (Concrete.—Approved Cement.)—All approved cement concrete shall consist of a standard Portland cement, torpedo sand and crushed stone or gravel, or crushed blast furnace slag, or crushed burnt clay, the volumetric quantity of any one of these materials combined with the torpedo sand shall not exceed nine times the volume of the Portland cement. All of the ingredients of cement concrete shall be thoroughly worked and wet so as to cover each piece of stone or gravel or slag or burnt clay with moistened cement; and the cement and sand shall fill the voids between the coarse material of the cement concrete.

Cement concrete to be considered a fireproof material shall be cast and rammed in an unset condition against the metal.

Sec. 503. (Machine or Hand Pressed Concrete.)—Machine or hand pressed concrete bricks or blocks are not considered in this chapter as a fireproof material for the protection of metallic structural members.

Sec. 504. (Brick, Burnt Clay, Tiles, Etc.—How Applied.)—Brick, burnt clay, hollow tiles, porous clay, solid tiles and terra cotta shall be applied to the metal in a bed of mortar.

Sec. 505. (Fireproof Covering.—Minimum Thickness Of.)—The minimum thickness of fireproof covering on any metal shall be, if of hollow tile, constructed in such a manner that there shall be not less than one air space of at least three-fourths of an inch, by the width of the metal surface to be covered, within the clay covering; if of porous clay tiles, the covering shall be at least one and one-half inches thick. The minimum thickness of concrete covering any metal shall be two inches.

Sec. 506. (Incombustible Materials.)—A metal or fire-resisting glass of not less than one-quarter inch in thickness, or plastering, or plaster blocks, or stone or granite, or marble, or an improved cinder concrete, or one of the fireproof materials described herein shall be considered an incombustible material as called for by this chapter.

Sec. 507. (Concrete.—Cinder.—Floor Filling.—Specifications For.)—Whenever the use of a cinder concrete is permitted by this chapter, such cinder concrete shall be composed of the following named ingredients, in the proportion here described, to-wit: Five parts of clean, thoroughly burnt steam boiler cinders, no particle of which shall be larger than one (1) inch; three parts of clean grit sand, or of clean stone screenings, and one part of a Standard Portland cement; the working and wetting of these ingredients shall be done in the same manner as required for cement concrete in Section 502 of this chapter, and such a mixture of approved cinder concrete may be used only for floor filling.

Sec. 508. (Fireproof Covering.—Measurements.)—In every case the thickness of the covering specified in this chapter shall be measured from the extreme projection of the metal, unless otherwise provided herein.

Sec. 509. (Skeleton Construction.)—The term "skeleton construction" shall apply to all buildings wherein all external and internal loads and strains are trans-

mitted from the top of the building to the foundations by a skeleton or framework of metal. In such metal framework the beams and girders shall be riveted to each other at their respective junction points. If columns made of rolled iron or steel are used, their different parts shall be riveted to each other, and the beams and girders resting upon them shall have riveted connections to unite them with the columns. If cast iron columns are used, each successive column shall be bolted to the one below it by at least four bolts not less than three-fourths of an inch in diameter, and the beams and girders shall be bolted to the columns. At each line of floor or roof beams, lateral connections between the ends of the beams and girders shall be made in such manner as to rigidly connect the beams and girders with each other in the direction of their length.

Sec. 510. (**Walls.—Enclosing.**)—If buildings are made fireproof entirely, and have skeleton construction so designed that their enclosing walls do not carry the weight of floors or roof, then their walls shall be not less than twelve inches in thickness; provided, such walls shall be thoroughly anchored to the iron skeleton, and whenever the weight of such walls rests upon beams or columns, such beams or columns shall be made strong enough in each story to carry the weight of wall resting upon them without reliance upon the walls below them. All walls shall be of fireproof or incombustible material.

Sec. 511. (**Columns.—Exterior.**)—All iron or steel used as a vertical supporting member of the external construction of any building exceeding sixty feet in height shall be protected as against the effects of external changes of temperature, and of fire, by a covering of fireproof material consisting of at least four inches of brick, or of four inches of concrete, or of four inches of burnt clay tiles, or of four inches of hollow terra cotta, or of a combination of any two of these materials, provided that their combined thickness is not less than four inches. The thickness of four inches shall be measured from the extreme projections of the metal of the column proper.

Where stone or other incombustible material is used for the exterior facing of a building, the distance between the back of the facing and the extreme projections of the metal of the column proper shall be at least four inches, and this four-inch space shall be filled with one of the fireproof materials.

In all cases, the brick or burnt clay, tile or terra cotta, if used as a fireproof covering, shall be bedded in cement mortar close up to the iron or steel members, and all joints shall be made full and solid.

Sec. 512. (**Fireproofing of Exterior Sides of Mullions.**)—In buildings required by this chapter to be of fireproof construction, all vertical door or window mullions over eight inches wide shall be faced with incombustible material; horizontal transom bars over six inches wide shall be faced with a fireproof or with an incombustible material.

Sec. 513. (**Spandril Beams, Girders, Lintel.**)—The metal of the spandril beams or spandril girders, or lintels of exterior walls, which support a part of exterior walls, shall be covered in the same manner, and with the same material, as specified for the exterior columns in this chapter. The covering thickness shall be measured from the extreme projection of the metal in every case.

Sec. 514. (**Fireproof Covering Independent.**)—All covering of brick, concrete, burnt clay tiles, hollow terra cotta or of a combination of any two of these materials shall be applied to all of the structural members of the exterior of a fireproof building previously and independently of the application of the architectural facing of such fireproof building with an incombustible or fireproof material.

Sec. 515. (**Iron or Steel Plates for Support of Wall.**)—If iron or steel plates or angles are used in each story for the support of the facings of the walls within such story, such plates or angles shall be of sufficient strength to carry the weight within the limits of fiber stress for iron and steel elsewhere specified in this chapter, the enveloping material for such story, and such plates or angles may extend to within two inches of the exterior of such covering.

Sec. 516. (**Walls, Support and Fireproofing Of.**)—Where skeleton construction is used for the whole or part of a building, the enveloping material and the walls shall be independently supported on the skeleton frame for each individual story.

Sec. 517. (**Terra Cotta.**)—If terra cotta or other hollow blocks are used, as fireproof covering, they shall be backed up with brick or hollow tile or concrete; whichever is used shall be, however, of such dimensions and laid up in such a manner that the backing will be built into the cavities of the facing so as to secure perfect bond between the facing and its backing.

Sec. 518. (**Coping.**)—The upper surfaces of all breaks or offsets in external coverings and fillings and walls, as well as the tops of walls, shall be covered with stone, terra cotta, metal, concrete or fire clay copings set in cement mortar. Copings of all kinds which do not have lapped joints shall be pointed with mortar composed of one part of standard Portland cement and two parts of torpedo sand.

Sec. 519. (**Columns.—Interior.**)—The covering of interior columns shall be one or more of the fireproof materials herein described.

If such covering shall be of brick or concrete it shall be not less than four inches thick; if of burnt clay tiles such covering shall be in two consecutive layers, each not less than two and one-half inches thick, with one air space; if of porous clay solid tiles it shall consist of at least two layers not less than two inches thick each, or if constituted of a combination of any two of these materials, one-half of the total thickness required for each of the materials shall be applied, of each of such materials. Whether hollow tile, porous tile or terra cotta is used, the two consecutive layers shall be so applied that neither the vertical nor the horizontal joints in the same shall be opposite each other, and each course shall be so anchored and bonded within itself as to form an independent and stable structure.

In all cases, the brick or hollow tile, solid tiles or terra cotta shall be bedded in cement mortar close up to the iron or steel member, and all joints shall be made full and solid.

In the case of columns having an "H" shaped cross section or of columns having any other cross section, with channels or chases open from base plates to cap plates on one or more sides of the columns, then the thickness of the fireproof covering may be reduced to three inches, measuring in the direction in which the flange or flanges project, and provided that the thin edge in the projecting flange or arms of the cross sections does not exceed three-quarters of an inch in thickness. The thickness of the fireproof covering on all surfaces measuring more than three-quarters of an inch wide and measuring in a direction perpendicular to such surfaces shall be not less than that specified for interior columns in the beginning of this section, and all spaces, including channels or chases between the fireproof covering and the metal of the column, shall be filled with a solid fireproof material. Lattice or other open columns shall be completely filled with approved cement concrete.

Sec. 520. (**Foundations.—Steel In.—Concrete Around Bottom of Columns.**)—If steel or iron in any form is used as part of a foundation, it shall be thoroughly imbedded in a concrete, the ingredients of which shall be such that, after proper ramming, the interior of the mass will be free from cavities. The steel or iron shall be entirely enveloped in approved cement concrete, and around the exposed external metal surfaces of such foundation there shall be a covering of approved cement concrete not less than four inches thick.

After the bases or base plates and columns have been set in place, both shall be protected from the effects of moisture by a covering of approved cement concrete applied direct to the metal in an unset state, measuring not less than two and one-half inches thick from the extreme projection of the metal, filled solid into all spaces, and forming a continuous concrete mass from the grillage or other foundations to an elevation six feet above the floor level nearest the column base plate or column stool.

Sec. 521. (**Columns.—Wiring Clay Tiles On.**)—Burnt clay tile column covering shall be secured by winding wire around the columns after the tile has all been set around such columns. The wire shall be securely wound around the tile in such manner that every tile is crossed at least once by a wire. If iron wire is used it shall be galvanized, and no wire used shall be less than No. 12 gauge.

Sec. 522. (**Fireproofing.—Protective Covering For.**)—In places where there is trucking or wheeling or other handling of packages of any kind, the lower five feet of the fireproofing of such columns shall be encased in a protective covering either of iron or oak plank, which covering shall be kept continually in good repair.

Sec. 523. (**Pipes Inclosed by Covering.**)—Pipes shall not be inclosed in the fireproofing of columns or in the fireproofing of other structural members of any fireproof building, provided, however, gas or electric light conduits not exceeding one inch inside diameter may be inserted in the outer two inches of the fireproof of such structural member.

Sec. 524. (**Shafts, Etc.**)—In cases where a pipe, conduit, dumb waiter, cable, wire, conveyor, belt or any combination thereof passes from one story to another story through an open hatch or floor opening, a shaft or enclosure of fireproof material shall be built from floor to floor around such hatch or floor opening, in each story above and below such hatch or floor opening in the same manner as described for fireproof partitions in this chapter. The area of space thus inclosed shall not exceed the area of the hatch or floor opening by more than one hundred per centum.

In no case shall any wood be used in the construction or support or fittings of such shaft as described above. If such holes in floors as described above in this section are not enclosed by such fireproof enclosures, then the open spaces in each floor opening not occupied by pipes, conduits, cables, wires, conveyors, belts or any combination thereof, shall be filled solid with fireproof material not less than eight inches thick.

Sec. 525. (**Shafts, Partitions Around, Plastering of Shafts, Doors and Windows.**)—All burnt clay or terra cotta partitions or walls around shafts having openings in floors shall be plastered on the outside and plastered or pointed on the inside.

All doors, frames, sashes, casings and windows in partitions or walls around floor openings, or around stair shafts or elevator shafts, shall be built of incombustible material. The supports of such doors, frames, sashes, casings and windows shall also be of incombustible material; in the case of doors, such supports shall be of rolled structural metal extending from floor to ceiling and secured to both. Where there are brick walls of twelve inches or more in thickness, the supports need not extend to ceiling as above specified. All glass used in connection with such partitions or walls shall be fire resisting.

Sheet metal work pressed over asbestos paper and wood may be used for the doors, frames, sashes and casings, and for openings in such partitions, except for elevator doors in shafts and where the provisions of this chapter require all metal doors.

Sec. 526. (**Beams and Girders, Coverings Of.**)—The beams and girders of the interior structural parts of a building shall be covered by one of the fireproof materials, so applied as to be supported entirely by the beam or girder protected, and shall be held in place by the support of the flanges of such beams or girders and by the cement mortar used in setting. If metal binding or metal anchors are used as fastenings of such fireproof covering, such metal binding or such metal anchor shall be protected by not less than one-half inch of fireproof covering.

If the covering is of brick it shall be not less than four inches thick; if of hollow tiles or if of solid porous tiles, or if of terra cotta, each of such tiles shall be not less than one and one-half inches thick, applied to the metal in a bed of cement mortar; hollow tiles shall be constructed in such a manner that there shall be one air space of at least three-fourths of an inch by the width of the metal surface to be covered within such clay coverings; the minimum thickness of concrete on the bottom and sides of metal shall be two inches.

The top of all girders and beams shall be protected with two inches of brick or one and one-fourth inches of burnt clay, or two inches of approved cement concrete, or three inches of approved cinder concrete. The brick or burnt clay shall be bedded solid on the metal in cement mortar.

In all cases of beams or girders, in roofs or floors, no matter what the material or form of the floor arch used, the protection of the bottom flanges of the beams and girders and so much of the web of the same as is not covered by the arches shall be made as hereinbefore specified for the covering of beams and girders. In every case the thickness of the covering shall be measured from the extreme projection of the metal, and the entire space or spaces between the covering and the metal shall be filled solid with one of the fireproof materials excepting the air spaces in hollow tile.

Sec. 527. (**Girders and Trusses.**)—All girders or trusses, when supporting loads from more than one story, shall be fireproofed with two thicknesses of fireproof material or a combination of two fireproof materials, as required for exterior columns in Section 511 of this chapter, and each covering of fireproof material shall be bedded solid in cement mortar.

All other girders or trusses supporting only a ceiling or roof shall be covered with a fireproof covering as specified for beams and girders in Section 526 of this chapter.

Sec. 528. (**Cut-Out Boxes, Chases, Etc.**)—No electric service cut-out box, switch box, cabinet, chase or any other recess, shall encroach on the minimum thickness required for any fireproof covering on structural metal, except as provided in Section 523 of this chapter. If the depth of any cut-out box, switch box, cabinet, or chase, or of any other recess, is to be concealed or partially concealed, then the thickness of the fireproof covering shall be increased correspondingly.

Sec. 529. (**Floor, Construction Of.—Hollow Tile Flooring.**)—Brick, hollow, tile, porous terra cotta, or approved cement concrete, or approved cinder concrete, shall be used for the construction of floors and roofs of fireproof buildings. Flat arch hollow tile, or flat arch porous clay tile floor arches shall have a height of at least one and one-half inch for each foot of span.

Hollow tile flat arch floor construction having a thickness of only one and one-half inch for each foot of span shall be used only for the minimum floor loads, and the area of burnt clay in the flanges and ribs, and webs of the hollow burnt clay tiles shall be proportioned to the safe value of resistance to compression of the materials used in the most stressed areas of the burnt clay.

Sec. 530. (**Segmental Arches.**)—Segmental arches shall have a rise of at least one inch for each foot of span of arch.

The least thickness of a hollow tile or porous terra cotta segmental arch shall be one-half of an inch per foot of span, but no such hollow tile or terra cotta arch shall be of a thickness less than five inches.

Both flat and segmental arches shall be so constructed that the joints of the same radiate from a common center and there shall be a cross rib for every four inches, or fractional part thereof, in height in each tile block. The skew back of the arches shall be carefully fitted to the beams supporting them, and in addition to the cross ribs there shall also be additional diagonal reinforcing ribs in the skew back. Such arches, whether flat or curved, shall have their beds well filled with cement mortar, and the centers shall not be struck until the mortar has set.

Burnt clay skew backs shall be molded in such a manner as to support the burnt clay covering on the under sides of beams or girders.

Sec. 531. (**Floors, Wood Surfacing and Nailing Strips.**)—Wood floor surfacing and wooden nailing strips for such wood floor surfacing may be used in fireproof buildings.

Where wood flooring is used in a fireproof building, the space immediately under such wood flooring, and between the wood nailing strips and under such wood nailing strips, shall be filled with a cement or a cinder concrete tamped into place in an unset state, or such other incombustible material as shall be approved by the Commissioner of Buildings.

Sec. 532. (**Partitions in Fireproof Buildings.**)—The partitions around stairs, stair halls, shafts, elevators or public lavatories shall be fireproof partitions, as described in Section 533 of this chapter; all other partitions in fireproof buildings shall be incombustible partitions. Where blocks are used for building partitions or as enclosing walls the joints shall be well filled with mortar.

The partitions shall be wedged tight between floors and ceilings with incombustible wedges.

Sec. 533. (**Partitions, Fireproof.—Incombustible.**)—Only fireproof material shall be used for fireproof partitions; if of brick, they shall be not less than four inches thick, and if of partition blocks, not less than three inches thick. If fireproof partitions are of reinforced concrete they shall be not less than two inches thick.

All fireproof partitions shall be supported directly by the steel construction, or by the fireproof floor arches, or stone concrete, or brick. No cinder concrete or wood flooring shall intervene between any such partition and its support.

All doors, windows, sashes, frames, casings and glass in fireproof partitions shall be built as required in Section 525 of this chapter.

Only fireproof or incombustible material shall be used in the construction of incombustible partitions, excepting that frames, casings, doors, sash and the rough carpenter work required for the proper fastenings of such frames, casings, doors or sash, may be of wood, and that ordinary glass may be used in doors and partition windows.

Sec. 534. (**Stairs, Landings.**)—Stairs in fireproof buildings shall be built of approved cement concrete, reinforced concrete, stone or with metal supports, metal strings, metal treads, metal platforms, or a combination of one or more of such materials.

If reinforced concrete is used in the construction of any stairs in a fireproof building, such stairs shall be designed according to the provisions of the sections applying to reinforced concrete.

Stairs shall carry a live load of not less than one hundred pounds per square foot on treads and landings, and every part of a stair shall be so designed that the safe limit of fiber stress is not exceeded.

The hand rails of such stairways may be of wood, all other material in such stairways in fireproof buildings shall be "fireproofed," or "incombustible" material, except cinder concrete.

If stairs are constructed of solid concrete, having the tread and riser in one piece, then there shall be not less than forty-five square inches of concrete in the cross section of such combined tread and riser, and such stairs shall have reinforced concrete or metal outer strings.

If stone treads or platforms are used they shall have a metal sub-tread, or sub-platform, of the same weight as if the metal alone were used.

If platforms have a floor arch sub-construction as described in Section 529 of this chapter, then the metal sub-platform may be omitted.

Sec. 535. (**Painting.**)—All structural metal which is used in a fireproof building, or which is used in any foundation, or which is used in reinforced concrete work, shall be clean and free of rust, or scale at the time of the enclosure or covering of such metal. All metal which is not to be fireproofed shall have two coats of first-class metal protecting paint.

Sec. 536. (**Rivets, Machine Driven.**)—All structural steel and iron work shall be so riveted that the distance from the center of the rivet hole to the edge of the materials shall be not less than:

- 5/8 inch for 1/2-inch rivets.
- 7/8 inch for 5/8-inch rivets.
- 1 1/8 inches for 3/4-inch rivets.
- 1 3/8 inches for 7/8-inch rivets.

Wherever possible, however, the distance from the rivet hole to the edge of the material shall be equal to two diameters of such rivet hole. All rivets, wherever practicable, shall be machine driven; the rivets in connection shall be proportioned and placed to suit the stresses, and the pitch of rivets shall never be less than three diameters of the rivets nor more than six inches. All holes shall be punched accurately, so that upon assembling a cold rivet will enter the hole without straining the material by drifting. The rivets shall fill the holes completely, and, whenever necessary, gussets shall be provided of thickness and size to accommodate the number of rivets necessary to make a connection.

Sec. 537. (**Truss Designs to Be Submitted.**)—When steel or iron trusses are used the trusses shall be of such design that the stress in each member may be calculated and all trusses when placed shall be held rigidly in position by an efficient system of lateral and sway bracing, and any member of a truss subjected to transverse stress in addition to direct tension or compression shall have the stress causing such strain added to the direct stresses coming on the member, and the total stresses shall in no case exceed the stresses provided for in Section 594 of this chapter.

Sec. 538. (**Trusses to Be Inspected.**)—On all buildings in process of construction, where the plans call for the use of trusses, or iron and steel structural work, the erection of such iron and steel structural work and of such trusses shall be inspected thoroughly by an inspector from the Building Department of the city, and such inspector shall be a man well versed in the design and construction of structural steel and iron work, and it shall be the duty of such inspector to see that the provisions of this chapter are strictly complied with, and such inspector shall have the authority to compel the contractors and builders to use a sufficient amount of temporary bracing or guys necessary to insure the safety of the work during its erection and to compel such contractors and builders to keep all derricks, tackles and hoisting appliances used in such work in a safe condition and to enforce all the provisions of this chapter.

Sec. 539. (**Bolts to Be Turned and Holes to Be Reamed.**)—Wherever it is found impossible to rivet connections as herein described and such connections are bolted, the bolts shall be turned and the holes reamed so as to get a perfect fit.

All structural members which are temporarily bolted together shall be well bolted in every alternate hole.

Sec. 540. (**Fireproof Buildings, Height Of.**)—The height of a fireproof building shall be measured from the average inside grade line of the street frontage of the building to the top of the highest point of the external bearing walls. Roof houses for elevators, or tanks, or skylights, or stairs, or scuttles may be built above the height of the main roof, and no building shall be erected in the city of greater height than two hundred and sixty feet.

Sec. 541. (**Roofs, Rise of Roof Above Limit of Height.**)—In the case of buildings which are entirely fireproof in their construction, and of which the roof is also entirely of fireproof construction, the roof may rise above the limit of height of wall fixed by this chapter for such buildings at a slope not to exceed thirty degrees with the horizon, and to a height not exceeding twenty feet above such limitation of the height of such wall. The space enclosed by such roof above the limitation of the height of such wall may be used as an enclosure for pipes, ventilating or elevator machinery or for ventilating ducts, but it shall not be lawful to use such space for purposes of storage, business or residence.

Sec. 542. (**Sheet Metal Work, Support Of.**)—Wood shall not be used as the support of any sheet metal work or of any gutter or cornice of a building more than one hundred feet in height.

Sec. 543. (**Reinforced Concrete.—Regulations in Regard to the Use of.**)—The term "reinforced concrete," as used in this chapter, shall be understood to mean an approved concrete mixture reinforced by steel of any shape, so combined that the steel will take up the tensional stresses and assist in the resistance to shear.

Sec. 544. (**Stress.**)—Reinforced concrete construction shall be of such nature that the stresses can be calculated according to the accepted formulas of modern concrete engineering practice.

Sec. 545. (**Permission to Erect.**)—Before permission to erect any reinforced concrete structure is issued, complete drawings and specifications shall be filed with the

Commissioner of Buildings, showing all details of the construction, the size and position of all reinforcing rods, stirrups, etc., and giving the composition of the concrete.

Sec. 546. (**Concrete.—Mixing Of.—Method of Testing.**)—The concrete shall be mixed in the proportions of one of cement, three of sand and five of stone, gravel or slag. The proportions shall be such that the resistance of the concrete to crushing shall not be less than two thousand pounds per square inch after hardening for twenty-eight days. The tests to determine this value shall be made by a competent engineer under the direction of the Commissioner of Buildings. The concrete used in reinforced concrete construction shall be what is usually known as a wet mixture.

Sec. 547. (**Cements.—Method of Testing.**)—Only high-grade Portland cements shall be used in reinforced concrete construction. Such cements, when tested neat, shall, after one day in air, develop a tensile strength of at least two hundred pounds per square inch; and after one day in air and six days in water shall develop a tensile strength of at least five hundred pounds per square inch; and after one day in air and twenty-seven days in water shall develop a tensile strength of at least six hundred pounds per square inch. Other tests as to fineness, constancy of volume, etc., made in accordance with the standard method prescribed by the American Society of Civil Engineers' Committee, may from time to time be prescribed by the Commissioner of Buildings.

Sec. 548. (**Sand.—Stone, Crushed Slag or Gravel.—Steel.**)—The sand to be used in such concrete shall be clean, sharp torpedo sand, free from loam or dirt.

The stone used in such concrete shall be clean, crushed stone or gravel, or crushed blast furnace slag of a size that will pass through a three-quarter-inch ring. The stone shall be fresh broken and the gravel shall be thoroughly washed.

The steel used shall be calculated according to its elastic limit; for moving or vibrating loads a steel of a lower elastic limit than is used for quiescent loads shall be used.

Sec. 549. (**Reinforcing.—Method Of.**)—All reinforcing steel shall be completely enclosed by the concrete, and such steel shall nowhere be nearer to the surface of the concrete than the diameter of such reinforcing steel bar, or rod or other shape. The steel in beams or girders shall be so disposed that there shall be not less than one and one-half times the thickness of the steel in concrete between the steel, and where more than two bars are used the bars shall be placed in two or more planes.

Reinforced concrete shall be so designed that the stresses in the concrete and the steel shall not exceed the following limits: Extreme fiber stress on concrete in compression, five hundred pounds per square inch; shearing stress in concrete, seventy-five pounds per square inch; concrete in direct compression, three hundred and fifty pounds per square inch; tensile stress in steel, one-third of the elastic limit; shearing stress in steel, ten thousand pounds per square inch.

The adhesion of concrete to steel shall be assumed to be seventy-five pounds per square inch of surface where bars are three-quarters of an inch or less in diameter and proportionately less for bars of a diameter greater than three-quarters of an inch.

The ratio of the moduli of elasticity of concrete and steel shall be taken as one to twelve.

The following assumption shall guide in the determination of the bending moments due to external forces: Beams and girders shall be considered as simply supported at the ends, no allowance being made for continuous construction over supports. Floor plates, when constructed continuous and when provided with reinforcement at top of plate over the supports, may be treated as continuous beams, the bending moment for uniformly distributed loads being taken at not less than W. L. divided by eight; the bending moment may be taken at W. L. divided by twenty in the case of square floor plates which are reinforced in both directions and supported on all sides. The floor plate to the extent of not more than five times the width of any beam or girder may be taken as part of that beam or girder in computing its moment of resistance.

The moment of resistance of any reinforced concrete construction under transverse loads shall be determined by formulas based on the following assumptions:

(a) The bond between the concrete and steel is sufficient to make the two materials act together as a homogeneous solid.

(b) The strain in any fiber is directly proportionate to the distance of that fiber from the neutral axis.

(c) The modulus of elasticity of the concrete remains constant within the limits of the working stresses fixed in this chapter.

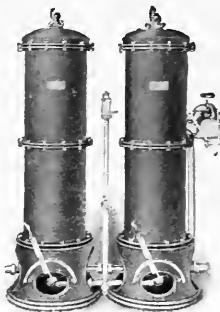
From these assumptions it follows that the stress in any fiber is directly proportionate to the distance of that fiber from the neutral axis.

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The tensile strength of the concrete shall not be considered.

Sec. 550. (**Construction.—Reinforced Concrete.**)—Reinforced concrete construction shall be designed so that the shearing stresses, both vertical and horizontal, developed in any part of the construction, shall not exceed the safe working strength of the concrete as fixed in this chapter, or a sufficient amount of steel shall be introduced in such a position that the deficiency in the resistance to sheer is overcome.

When the safe limit of adhesion between the concrete and steel is exceeded, some provision shall be made for transmitting the strength of the steel to the concrete.

Sec. 551. (**Columns.—Reinforced Concrete.**)—Reinforced concrete may be used for columns when the ratio of length to the least side or diameter does not exceed twelve. The reinforcing rods shall be tied together at intervals of not more than the least side or diameter of the column, or spirally wound steel may be used.

When vertical reinforcing rods are used in columns, such rods shall have their ends milled normal to the longitudinal axis, and such rods shall have full perfect bearings at each joint, and such joints shall occur only at floors or other points of lateral support and a tight fitting sleeve shall be provided at all joints of vertical reinforcing rods.

Sec. 552. (**Wind Pressure.**)—In the case of buildings in which allowances must be made for wind pressure as provided in Section 603 of this chapter, the reinforcing rods of columns shall be connected and the milled end surfaces shall be brought together by threading the rods and by threaded sleeve nuts, or threaded turnbuckles, or methods equally effective and satisfactory to the Commissioner of Buildings.

Sec. 553. (**Tests.—To Be Made by Contractor on Demand.**)—The contractor shall be prepared to make load tests on any portion of a reinforced concrete construction within a reasonable time after erection, as often as may be required by the Commissioner of Buildings. Such tests shall show that the construction will sustain a load twice that for which it is designed, without any sign of failure, or in the case of beams, girders or floors, without deflecting more than one-seven-hundredths of the span.

Sec. 554. (**Reinforced Concrete Walls.**)—Buildings of Classes I., II., III., VI. and VII. having a complete skeleton construction of steel or of reinforced concrete construction or a combination of both, designed to safely resist all of the strains caused by the dead weights of the structure and of the live loads and of the wind pressure within the safe limits of stress provided in this chapter for each material used, may have walls of reinforced concrete six inches thick for the upper two stories and walls seven inches thick for the two stories next below the upper two stories, and walls eight inches thick for the stories next below the upper four stories, and walls nine inches thick for the stories next below the upper six stories, and so on downwards, increasing the thickness of the walls one inch for each two stories or part thereof. Provided, however, that such walls shall support only their own weight, and that such walls have steel rods three-quarters of an inch in diameter or of an equivalent area set vertically, and spaced not more than eighteen inches apart, and steel rods five-eighths of an inch in diameter or of an equivalent area set horizontally tied to the vertical rod at each intersection with these, and set not to exceed twenty-four inches apart; and provided that where the weight of the walls of each story is not transferred to the skeleton by spandril beams, the vertical reinforcement shall be increased in weight in an arithmetical ratio of twice as much steel in the two stories next below the upper two stories, and three times as much steel in the two stories next below the upper four stories, and so on downward. Vertical bars shall be spliced together by winding with iron wire. Horizontal bars shall be wired to the columns. Additional bars shall be set around openings, the verticals wired to the nearest horizontal bars and the horizontal bars at top and bottom of openings shall be wired to the nearest vertical bars.

The steel rods shall be combined with the concrete and placed where the combination will develop the greatest strength, and the rods shall be staggered or placed and secured to the steel or reinforced concrete structural skeleton of the building, so as to resist a pressure of fifty (50) pounds per square foot, either from the exterior or from the interior on each and every square foot of each wall panel.

Sec. 555. (**Molded Hollow Concrete and Hollow Tile Block.**)—Molded hollow concrete blocks or molded hollow vitrified clay building blocks of the full thickness of a ten-inch wall may be used wherever eight-inch walls are called for by this chapter, and such blocks may also be used wherever twelve-inch brick walls are called for in this chapter under frame cottages and in one and two story Class III. and Class VI. buildings.

ARTICLE XIII.

SLOW-BURNING CONSTRUCTION.

Sec. 556. (**Slow-Burning Construction Defined.**)—The term "slow-burning construction" shall apply to all buildings in which the structural members which carry the loads and strains which come upon the floors and roofs thereof are made wholly or in part of combustible material, but throughout which the structural metallic members shall be protected against injury from fire by coverings of incombustible, non-heat conducting material similar to those described under the head of "skeleton construction," except that plastering and metallic lath may be used as provided herein. In the case of columns the metallic lath shall be fastened to metallic furrings and the plastering upon the same shall be of three coats of mortar. The lower five (5) feet of each column shall be protected as required for brick, concrete or tile covering in Section 522 of this chapter. A covering of three (3) coats of plastering on metallic laths shall be considered sufficient protection for the under side of joists and girders and a layer of mortar or other incombustible material at least one and one-half inches thick shall be applied on all floors and roof surfaces above the joists of the same.

Sec. 557. (**Posts, Partitions and Elevator Enclosures.**)—Where oak posts of greater sectional area than one hundred square inches are used, they need not be covered. All partitions and all elevator enclosures in buildings of this type shall be made entirely of incombustible material. The use of wood furring or of stud partitions shall not be allowed in buildings of this type.

Sec. 558. (**Stairs.—To be Incombustible.**)—Amended by ordinance Nov. 25, 1907, to read as follows:

Where buildings are required to be of "slow burning construction," all stairs in such building shall be of incombustible material; provided, however, said stairs may be of ordinary construction, if said building is equipped with an automatic sprinkler system, and stairs are enclosed in a fireproof wall.

ARTICLE XIV.

MILL CONSTRUCTION.

Sec. 559. (**Mill Construction Defined.**)—The term "mill construction" shall apply to all buildings in which all the girders and joists supporting floors and roof have a sectional area of not less than seventy-two square inches, and above the joists of which there is laid a timber floor not less than three and three-fourths inches thick. Wooden posts used in buildings of this type shall not be of smaller sectional area than one hundred square inches.

Sec. 560. (**Fireproofing.**)—Partitions and elevator enclosures in buildings of this type shall be made entirely of incombustible material. If iron columns, girders or beams are used in buildings of this type, they shall be protected as specified in this chapter, but the wooden posts, girders and joists need not be protected by fireproof covering. The use of wood furring, wood laths or stud partitions shall not be permitted in buildings of this type.

Sec. 561. (**Stairs.—To be Incombustible.**)—Amended by ordinance Nov. 25, 1907, to read as follows:

Where buildings are required to be of "mill construction," all stairs in such buildings shall be of "incombustible" material; provided, however, said stairs may be of ordinary construction, if said building is equipped with an automatic sprinkler system and stairs are enclosed in a fireproof wall.

Sec. 562. (**Concrete Construction.—Approved Cinder.**)—The term "approved cinder concrete construction" shall apply to all buildings in which all parts that carry weights or resist strains, all exterior walls, all interior walls, all interior partitions, all stairs and all elevator enclosures are made entirely of incombustible material, and in which all metallic structural members are protected against the effects of fire by approved cinder concrete proportioned, mixed, applied and secured as herein described. Approved cinder concrete construction may be used for all buildings in which fireproof construction is mandatory by this chapter, or where ordinary construction may be used.

Approved cinder concrete shall consist of a standard Portland cement, torpedo sand, and clean, thoroughly burnt steam boiler cinders, free from deleterious matter, no particle of which shall be larger than one inch.

Sec. 563. (**Cinders.—Quantity.**)—The volumetric quantity of the cinders combined with the torpedo sand shall not exceed the volume of the Portland cement by more than eight (8) times. All of the ingredients of approved cinder concrete shall be thoroughly worked and wet so as to cover each piece of cinder with moistened cement; and the cement and sand shall fill all of the voids between the cinders.

All approved cinder concrete shall be cast and rammed in an unset condition against the metal.

The minimum thickness of approved cinder concrete covering in structural metal shall be two (2) inches. In every case the thickness of the coverings shall be measured from the extreme projection of the structural metal unless otherwise provided this chapter.

Sec. 564. (**Columns.—Approved Concrete.—Coverings.**)—The approved cinder concrete covering of the columns shall be not less than three (3) inches in thickness from the extreme projection of the metal, including the plastering, and in all cases the cinder concrete shall be rammed solid against the column metal, filling all channels and open spaces within the perimeter of the finished plaster column. Approved cinder concrete column covering shall have metal binders of No. 8 gauge wire imbedded and around the columns for each sixteen (16) inches in height of the column, provided, however, that in buildings of approved cinder concrete construction the columns may be covered with one thickness of metal furring, metal lathing and not less than three coats of mortar.

In places where there is trucking or wheeling, or handling of packages of any kind, the lower five (5) feet of every column shall be incased in a protective covering such as is described in Section 522 of this chapter.

Sec. 565. (**Beams and Girders.—Approved Cinder Concrete Construction.**)—The beams and girders of a building built of approved cinder concrete construction shall be enclosed in approved cinder concrete which shall be not less than two (2) inches in thickness at any and all points of the structural metal work. The approved cinder concrete covering shall be reinforced with metal clips or wire binders, either or both of which shall not be more than sixteen (16) inches on centers in the direction of the length of the structural member.

The top of all girders or beams shall be protected with not less than two (2) inches of approved cinder concrete.

A floor or roof construction of approved cinder concrete may be used for any span between structural members that will carry the test loads required by this chapter for such floors and roofs.

Sec. 566. (**Segmental Arches.**)—Segmental arches shall be not less than three (3) inches in thickness at the crown.

Sec. 567. (**Floors.—Flat Slab Construction.**)—Flat slab floor construction shall be not less than four (4) inches in thickness for spans of eight (8) feet or less. Flat slab floor construction shall be not less than five (5) inches in thickness for spans between eight (8) and ten (10) feet.

Approved cinder concrete shall not be used as a floor or roof construction unless such approved cinder concrete is reinforced by steel or iron, and such reinforcement shall not weigh less than three-quarters of a pound per square foot of superficial surface.

All reinforcing steel shall be completely enclosed by the concrete.

Wood nailing strips for floor surfacing may be used in buildings of approved cinder concrete construction, provided, however, that such nailing strips shall be imbedded as described in Section 531 of this chapter.

Sec. 568. (**Partitions.**)—The partitions in buildings of approved cinder concrete construction shall be as described in Section 532 of this chapter for partitions in fireproof buildings, provided, however, that partitions may be built wholly of metal studding, metal lath and plaster, but no such partitions shall be of a less thickness than one and one-half (1½) inch.

The partitions around stairs, or stair halls, or shafts, or elevators, or public lavatories, shall be wedged tight between the structure of the floors and ceilings, or if such partitions are of plaster, the metal or metal studding shall be secured to the structure by clips, bolts or other metal fastening, and in no case shall any such partition be built on the wood flooring or wood nailing strips.

Sec. 569. (**Walls.—Enclosing.**)—The enclosing walls, the covering of exterior side of mullions, beams, girders, lintels, the enclosures of pipes, pipe shafts, the doors into shafts, windows into shafts, covering of girders, covering of trusses, cut-out boxes, chases, stairs, landings, painting, rivets, bolts, and all other items required in these sections on fireproof construction and in the sections on skeleton construction shall in buildings of approved cinder concrete construction be designed or built or covered, or made of the material called for, or any one or a number of these requirements, as described in such sections describing the requirements of skeleton construction or of fireproof construction in this chapter, provided, however, that approved cinder concrete as described herein may be used for all protective covering of structural metal.

ARTICLE XV. ORDINARY CONSTRUCTION.

Sec. 570. (Ordinary Construction Defined.)—The term "ordinary construction," as used in this chapter, means the ordinary system of construction in which timber and iron structural parts are not protected with fire resisting coverings.

ARTICLE XVI.

GENERAL CONSTRUCTION REQUIREMENTS.

Sec. 571. (Construction or Alteration of Buildings.)—Every building or structure, or part thereof, hereafter constructed, erected, altered, enlarged or changed anywhere within the city, shall be so constructed, erected, altered, enlarged or changed only in accordance with the provisions of this chapter.

Sec. 572. (Materials.)—Materials used in the construction of buildings of all classes shall conform to the following specifications:

Sec. 573. (Foundation Proportions.)—Foundations shall be proportioned to the actual average loads they will have to carry in the completed and occupied building.

Sec. 574. (Foundation Construction.)—Foundations shall be constructed of either of the following: Approved cement concrete, dimension or rubble stone, sewer or paving bricks or iron or steel or piles. If iron or steel is used the filling and the coating of the same shall be of Portland cement as provided in Section 583 of this chapter, piles shall be covered with grillage of timber, concrete or steel, or a combination of these. Where timber grillage or timber piles are used, the top of such grillage or such piles shall be at least one foot below city datum.

Sec. 575. (Foundation of New and Old Walls.)—In all cases where there is an increase in the thickness of walls, a new foundation shall be built in such manner as to carry jointly both the new and old walls, and the soil under such foundations shall not be loaded beyond the limits hereinbefore specified in this chapter. All foundations shall be protected against the effects of frost, and frozen cement mortar shall not be used in connection with building operations.

Sec. 576. (Foundations.—Pile Borings Required.—Safe Load Required.—Fiber Stress.)—Where pile foundations are used, auger borings of the soil shall first be made to determine the position of the underlying stratum of hard clay or rock, and the piles shall be made long enough to sustain the required load according to approved formulas for pile driving, and timber piles shall not be loaded more than twenty-five tons to each pile. The heads of the piles are to be protected against splitting while they are being driven, and after having been driven the piles are to be sawed off to a uniform level and covered with a grillage so proportioned that in the transmission of the load from the structure to the pile the extreme fiber stress of the grillage shall not exceed the safe limits for the respective materials as prescribed in this chapter. The safe compression load per square inch on concrete in concrete piles shall not exceed four hundred pounds. The area of the cross section shall be measured at a point six (6) feet below the head of the pile after the same has been set in place, and the cross section of the pile above this point shall not be reduced.

Sec. 577. (Foundations Other than Pile.)—If foundations of other materials than piles are used, they shall be so proportioned that the loads upon the soil shall not exceed the limits for different kinds of soil than those hereafter given, to-wit:

Sec. 578. (Load for Various Soils.)—If the soil is a layer of pure clay at least fifteen feet thick, without admixture of any foreign substance excepting gravel, it shall not be loaded more than at the rate of three thousand five hundred pounds per square foot. If the soil is a layer of pure clay at least fifteen feet thick, and is dry and thoroughly compressed, it may be loaded not to exceed the rate of four thousand five hundred pounds per square foot.

If the soil is a layer of dry sand fifteen feet or more in thickness, and without admixture of clay, loam or other foreign substance, it shall not be loaded more than at the rate of four thousand pounds per square foot.

If the soil is a mixture of clay and sand it shall not be loaded more than at the rate of three thousand pounds per square foot.

Sec. 579. (Foundations in Wet Soil. —Trenches to Be Drained.)—In all cases where foundations are built in wet soil, it shall be unlawful to build the same unless the trenches in which the work is being executed are kept free from water by bailing, pumping or otherwise, until after the completion of work upon the foundations, and in each case a connection with the street sewer shall be established before beginning the work of laying foundations.

Sec. 580. (Foundations.—Where Not Permitted.)—Foundations shall not be laid on filled or made ground or on loam, or on any soil containing admixture of organic matter.

Sec. 581. (**Foundations.—Depth Below Surface.—Least Limit.—Depth Regulated Sewer.—Exceptions.**)—Foundations shall in all cases extend at least four feet below the surface of the ground upon which they are built, and in the case of all buildings forty feet or more in height, foundations shall extend at least to the depth gained by the street sewer in the neighboring streets or alleys; but if such sewers are at a greater depth than ten feet below the sidewalk grade, such foundations need not extend to a greater depth than ten feet, provided that sound, hard soil is found at that depth.

Sec. 582. (**Concrete.—Broken Stone.—Sand.—Cement.—Mortar.—Foundations Of.**)—Broken stone or concrete in making foundations shall be clean and free from dirt and dust. And sand shall be free from admixture of loam and shall be otherwise clean and sharp.

Cement shall have been kept dry and shall be used fresh from the package; cement which has been permitted to become wet, hard or lumpy before it is mixed into the mortar or concrete shall not be used.

The use of concrete or mortar of any kind, the ingredients of which are not thoroughly and completely mixed and which are not free from lumps, or other unixed portions of any of the ingredients, is prohibited; and also the use of cement mortar which has become partly or wholly set before use. Concrete foundations wherever used shall have boxes of plank all around them, and the concrete shall be well rammed in individual layers not more than six inches each in thickness. The ramming shall be continued until the water stands on the top of the mass of concrete.

Sec. 583. (**Steel Rails or Beams in Concrete.**)—If steel or iron rails or beams are used as parts of foundations, they shall be thoroughly imbedded in a concrete, the ingredients of which shall be such that after proper ramming the interior of the mass will be free from cavities, the beams or rails shall be entirely enveloped in concrete, and around the exposed external surfaces of such concrete foundations there shall be a coating of a standard cement concrete not less than four inches thick.

Sec. 584. (**Concrete Foundations.—Steps.—Safe Load Where Reinforced by Iron or Steel.**)—If concrete foundations are used by themselves and without the insertion of iron or steel beams or rails, the offset on top of same shall not be more than two-thirds the height of the respective courses, and such concrete foundations shall not be loaded more than twenty-five thousand pounds per square foot. If reinforced by iron or steel beams or rails, the loads and offsets in the same shall be so adjusted that the fiber stress upon the metal, if iron, shall not exceed twelve thousand pounds per square inch, or, if steel, that the fiber stress shall not exceed sixteen thousand pounds per square inch.

Sec. 585. (**Dimension Stones.—Safe Load.**)—Dimension stones shall have uniform beds and the offsets in the same, where two or more layers are used, shall not be more than three-quarters of the height of the individual stones. They shall be set in full beds of cement mortar under their entire area, and in such manner that they will not rock after being set. Dimension stones in foundations shall not be subjected to a load of more than twenty thousand pounds per square foot in tiers.

If the beds of the stones are dressed and leveled off to a uniform surface and the stones are set in a standard cement mortar, this strain may be increased to twenty-five thousand pounds per square foot.

Sec. 586. (**Rubble Stone.**)—Rubble foundations and rubble walls shall be built approximately square and flat bedded stones, well and thoroughly bonded in both directions of the walls, each stone thoroughly bedded in mortar under its entire area. Whenever walls of any kind are used as curb walls, their exterior surfaces shall be rendered approximately water tight by a coating of a standard cement mortar.

Sec. 587. (**Brick.—Soft.—Use Of.—Bond.—Safe Load.**)—The use of soft bricks is prohibited in all parts of buildings exposed to the weather and in internal or external piers or bearing walls. The bond of brick work shall be formed by laying one course of headers for every five courses of stretchers. Brick work in walls laid in a standard Portland cement mortar shall not be loaded more than twenty-five thousand pounds per square foot. Brick work laid in an ordinary cement mortar shall not be loaded more than eighteen thousand pounds per square foot. Brick work in walls laid in lime mortar shall not be loaded more than thirteen thousand pounds per square foot.

Sec. 588. (**Walls.—Ledges.—Joists Supports.—Walls Around Stairs, Elevators and Stairs.**)—Whenever walls sixteen inches or less in thickness shall be used for the support of ordinary joists in buildings of all classes, ledges of the thickness of the string, lath and plaster shall be formed between such joists and shall be carried up and leveled off on the line of the tops of the joists, or standard cast iron joist boxes shall be used for the support of such joists.

Where a stairway or an elevator shaft or an air shaft is surrounded by brick walls, such surrounding brick walls may be built sixteen (16) inches thick, excepting that the upper fifty (50) feet of the height may be built twelve (12) inches thick, but the length or breadth, or either, of such a stairway or elevator shaft or air shaft shall not exceed twenty-five (25) feet, and in no case shall the load on the brick of such wall or walls exceed the safe limits of load specified for brick work in this chapter.

Sec. 589. (**Pressed Brick Facing.—Bond Joints.**)—If pressed brick facings are used, they shall be bonded into their backing every seventh course. Bond shall be established by solid headers or by blind headers. In the case of piers faced with pressed brick, only solid headers shall be used, but bond stones or iron bond plates may be substituted for such headers. Pressed brick in all cases shall be so laid as to have a full bed of mortar under its entire surface. The laying of pressed brick merely with a joint all around the outer edge of the bricks shall be unlawful.

Sec. 590. (**Brick Piers.—Offsets.—Bond Stone.—Cap Stone.**)—In building brick piers there shall be provided at every offset in each pier, or at every point where such brick pier receives the load, a bond stone at least eight inches thick or a plate of rolled iron or steel not less than one-fourth of an inch in thickness, which stones or plates, if at the top of such pier, shall cover its entire surface, and shall in all cases be adapted to receiving the load to be imposed and shall be made of a strength which will keep the fiber strain upon the material used within the limits elsewhere herein stated.

Sec. 591. (**Stone Facing Without Bond Courses.**)—Stone may be used as facing for brick walls under the following conditions: If the facing is ashlar, without bond courses, and the individual course thereof measure in height between bond stones more than six times the thickness of the ashlar, then each piece of ashlar facing shall be united to the brick work with wrought iron anchors at least two to each piece and reaching at least eight inches over the brick wall, and hooked into the stone facing as well as the brick backing. Wherever ashlar as before described is used, it shall not be counted as forming part of the bearing surface of the wall, and the brick backing shall be of the thickness of wall herein specified for the different kinds of building.

Sec. 592. (**Stone Facing with Bond Courses.**)—If stone facing is used with bond courses at a distance apart of not more than four times the thickness of the ashlar, and where the width of bearing of the bond courses upon the backing of such ashlar is at least twice the thickness of the ashlar, and in no case less than eight inches, then such ashlar facing shall be counted as forming part of the wall and the total thickness of wall and facing shall not be required to be more than herein specified for walls of the different classes of buildings.

Sec. 593. (**Stresses.—Cast Iron.—Fiber.—Strains.—Length.**)—The stresses in materials used in construction produced by the calculated strains due to their own weight and applied loads shall in no case exceed the following:

CAST IRON.

| | |
|-----------------------------------|-------------|
| Extreme fiber strain tension..... | 2,500 lbs. |
| For columns | 10,000 lbs. |

Reduced by Gordon's formula. Reduced for eccentric load.

No cast iron column shall have a length to exceed twenty-four times its diameter, or least side.

Sec. 594. STRESSES IN POUNDS PER SQUARE INCH.

| | Wrought | Iron. | Steel. |
|---|---------|--------|--------|
| Extreme fiber stresses, "I" beams and shapes..... | 12,000 | 16,000 | |
| Extreme fiber stresses, built beams..... | 10,000 | 15,000 | |
| Tension | 12,000 | 15,000 | |
| Shearing | 7,500 | 10,000 | |
| Direct bearing pins and rivets..... | 15,000 | 20,000 | |
| Bending on pins | 18,000 | 22,500 | |
| *For columns and compression members..... | 12,000 | 15,000 | |

*Reduced for ratio of length of columns to its least radius of gyration by approved modern formulas, and reduced for eccentric loading.

Sec. 595. TIMBER—STRESSES IN POUNDS PER SQUARE INCH.

| | On Extreme | Shearing | Compression Per- |
|-------------------------------|------------|-------------|------------------|
| | Fiber | Along Grain | pendicular to |
| White Pine and Spruce..... | 750 | 80 | 150 |
| White Oak | 1,000 | 150 | 250 |
| Long-leaved Yellow Pine | 1,250 | 100 | 250 |

Sec. 596. (Posts with Flat Ends.—Stresses per Square Inch.)—

L. Length of posts in inches.

D. Least side or diameter of post in inches.

S. Stress per square inch.

| White Pine | | L. L. Yellow Pine. | | White Oak. |
|------------|-----|--------------------|-------|------------|
| Spruce. | | L. D. | S. | S. |
| L. D. | S. | 0-15 | 1,000 | 750 |
| 0-10 | 625 | 15-30 | 875 | 650 |
| 10-35 | 475 | 30-40 | 750 | 560 |
| 35-45 | 375 | 40-45 | 625 | 460 |
| 45-50 | 300 | 45-50 | 500 | 375 |

GENERAL PROVISIONS.

Sec. 597. (Walls.—Eight-Inch Brick Wall.—Height Limited.)—In no case, in any class of building, shall any eight-inch brick wall be more than fourteen feet in height.

Sec. 598. (Cement Concrete Walls.—Solid.)—Approved cement concrete of the same thickness as is required where common brick or rubble stone is used, may be substituted for either of these materials wherever either is called for in this chapter.

Sec. 599. (Walls.—Thickness Of.)—The thickness of walls set forth in the tables for the various classes of building shall, for each class of buildings, apply to all external enclosing walls, and also to such internal walls as may be required under the specifications of the different classes of buildings.

Sec. 600. (Bay Windows and Light Shafts.—Material For.)—Bay or oriel windows and light shafts may be built of combustible material, as specified in Section 287 of this ordinance.

Sec. 601. (Buildings.—Height Of.)—The limits of heights of buildings hereinbefore given for non-fireproof buildings, shall be from the average established sidewalk level to the highest point of roof thereof.

No buildings shall be erected in the city of greater height than two hundred and sixty feet from the sidewalk level to the highest point of external bearing walls. The erection of parapet walls or of balustrades constructed entirely of incombustible material is permitted above the roof level of buildings of all classes, and in addition to the heights herein fixed for the same. (See Sections 540 and 541.)

Sec. 602. (Floor Areas.—Computation Of.—For All Classes of Buildings.)—
Stairs in Common.)—The floor areas of all buildings shall be computed from the dimensions taken on the inner side of the exterior or surrounding walls on the floor of the third story, and the areas of courts, of elevator shafts, of enclosed stairs, if enclosed with incombustible materials, and of chimneys, shall not be considered as a part of such floor areas.

Where two areas of the same building adjoin, and are separated by fireproof dividing walls, they may have a stairway in common. Provided, however, in fireproof buildings such stairways shall be of incombustible material, enclosed in fireproof partitions, and access to such stairway shall be direct from each such area. Provided, however, in buildings of mill, slow-burning or ordinary construction, such stairways shall be of incombustible materials, enclosed by brick walls, and that doors to such stairways shall be automatic, self-closing standard iron doors, as described in Section 260 of this chapter, and all materials inside of such brick walls shall be fireproof or incombustible material.

Sec. 603. (Wind Pressure.—Precautions Against.)—In the case of all buildings the height of which is more than one and one-half times their least horizontal dimension, allowances shall be made in both vertical and horizontal construction for wind pressure, which shall not be figured at less than thirty pounds for each square foot of external wall surface.

Sec. 604. Basement.—Meaning Of.—Cellar.—Meaning Of.)—Wherever in this chapter the words "basement story" are used, it is intended to mean that the floor of such story is at a distance of two feet or more below the level of the sidewalk, and that its height does not exceed eleven feet in the clear. If the floor of such story is nearer than two feet to the sidewalk grade, or if the ceiling of such basement is more than nine feet above the sidewalk grade, it shall be counted as the first story of the building in which it occurs, except in buildings of Class VI. and Class VIII. as defined in Sections 246 and 248 of this chapter.

"Cellar" is a story, the height of which is more than two-thirds below the level of the grade at the building.

Barrett Specification Roofs



What the Barrett Specification Aims to Accomplish

Architects, Engineers and practical men generally have recognized the fact that roofs of coal tar pitch, tarred felt and slag or gravel, when properly laid, give longer service at less cost than any other kind. Most roofing contractors can readily cite instances where these "tar and gravel roofs," as they were loosely called, have endured without repair or attention for twenty years and over, and are still in serviceable condition.

For many years however, the lack of a definite specification, covering weight of the felt, the number of plies, the kind and amount of pitch, the manner of laying the roof, and other details which were essential to the effective use of the materials, gave to the proposition an element of uncertainty which it was very desirable should be eliminated.

Many specifications in the past have called for simply "a five ply gravel roof," or "a first-class gravel roof," or "a tar and gravel roof laid in a manner satisfactory to the engineer," etc.

Specifications of this character naturally produced roofs which, in some instances, did not give maximum service; but the great majority, even when laid under these loosely drawn specifications, gave better service than any other kind.

It was of vital importance to us, as the largest manufacturers of this class of roofing materials, to have uniformly good results obtained wherever or by whomever gravel roofing was used. Therefore it was decided to prepare a Specification in accordance with the best roofing practice of the day, which would clearly define a roof of coal tar pitch, tarred' felt, and gravel or slag that would give the maximum of durability at the minimum cost.

The outcome, after much careful work, was *The Barrett Specification*.

With this Specification at hand the architect or owner, without any technical knowledge, can make sure of getting the very best results from these materials at the smallest cost per year of service.

Copy of same mailed on request.

Barrett Manufacturing Company

New York Philadelphia Chicago Boston Cleveland Pittsburgh Cincinnati
Kansas City Minneapolis New Orleans St. Louis London, Eng.

Sec. 605. (**Sub-Basements and Cellars.—Construction Of.**)—No building may have more than one basement or cellar of ordinary or slow-burning or mill construction, all additional basements or cellars shall be of fireproof construction, as described in this chapter, all elevator enclosures shall be of brick from the lowest basement floor level to the first story floor, and all stairways shall be enclosed in fireproof partitions from the lowest basement floor level to the first story floor level with automatic closing standard iron doors, opening outwards.

In cases where a pipe, conduit, dumb-waiter, cable, wire, conveyor or belt, or any combination thereof passes from one basement to another through a floor the opening in the floor shall be enclosed as specified in Sections 524 and 525 of this chapter.

The number and width of stairs from the lowest basement floor to the first story shall be the same as required for the four highest stories of a building of the same area.

Sec. 606. (**Enclosures Upon Roofs.—Parapets and Balustrades Upon Roofs.**)—It shall be permitted to erect on the roofs of all buildings more than sixty feet and less than one hundred feet high, skylights, enclosures for water tanks and enclosures for elevator machinery, the construction of all of which enclosures shall be entirely of incombustible material; provided, however, that the roofs of same may be built of mill or slow-burning construction.

Sec. 607. (**Fire Walls.—When Dispensed With.**)—Fire walls of brick not less than twelve inches thick shall be built extending above the roofs of buildings if such roofs are flat, and also above the roofs of all buildings where the same abut against another building, or where the same stand upon any line of any lot, excepting street or alley lines. Provided, that where eight-inch walls are permitted in the top story of buildings, or as provided in Classes III. and VI. for buildings not over three stories high, the fire walls shall be of the same thickness. Such fire walls, where they stand upon lot lines, or where they are over the dividing walls in the interiors of buildings where such are called for by this chapter, by reason of the great area of such buildings, shall extend at least three feet above the roofs of such buildings. Fire walls upon street and alley lines shall extend not less than eighteen inches above the roofs of such buildings. Fire walls may be dispensed with on street and alley lines if the tops of the roof boards and roof joists are protected against fire for a distance of at least five feet from such street or alley lines by a coating of deafening mortar on hollow tile or porous tile at least two inches thick. Fire walls at street and alley lines may also be dispensed with in all cases where the entire framing and materials of the roof shall be made strictly fireproof.

Walls facing upon courts and light shafts shall be treated as in the same category with walls facing upon streets and alleys.

Fire walls shall be covered with a weatherproof coping of incombustible material.

Sec. 608. (**Window and Door Sills.—Columns and Lintels Supporting Store Fronts.—Incombustible.**)—Window and door sills shall be made of incombustible material. Oak timber used for door sills and not less than eight inches thick by the full width of the wall in which such sills occur, shall, for the purpose of this chapter, be counted incombustible, but no other form or use of wood construction shall be considered incombustible.

The columns and lintels supporting store fronts in buildings within the fire limits of more than one story in height shall be made of incombustible material.

Sec. 609. (**Roofs.—Shingle or Gravel.**)—The use of single roofs or of other forms of combustible roof covering upon buildings erected or altered within the fire limits is prohibited. Provided, however, that shingle roofs may be placed on buildings not exceeding two stories in height and two thousand square feet in area, but the shingles used on such roofs shall first have been dipped in fire-resisting paint, such fire-resisting paint to be approved by the Commissioner of Buildings.

Roofs whose slope is not more than three inches per foot horizontal, and the covering of which is made with a composition of felt and gravel, shall be considered incombustible under the provisions of this chapter, and may be used upon buildings of all classes.

Sec. 610. (**Roofs.—Construction of.—Pitch Of.—Strength Of.**)—In the case of all buildings less than sixty feet in height, roofs having a slope of more than specified for composition roofs, may be made of timber and board construction, and shall be covered with incombustible material, except as provided in Section 609 of this chapter. The roofs upon buildings sixty or more feet and less than ninety feet high, and of greater slope than three inches to the foot and less slope than thirty degrees with the horizon, shall, if made of timber construction, have an incombustible covering upon the roof boards, which shall be made either of mortar or porous terra cotta or plaster boards, or other incombustible material, and which shall be at least two

inches thick. If this covering is made upon the roof boards, wooden strips shall be inserted and securely fastened to the wooden substructure at regular intervals between the incombustible covering, and a weatherproof covering of incombustible material.

The roofs of all buildings of every kind and class shall be designed and constructed in such a manner that they will bear a load in addition to the weight of their structure and covering of at least twenty-five pounds for each square foot of horizontal surface.

Sec. 611. (**Roofs.—Pipes Carrying Water From.**)—The water from all roofs shall be carried to the street sewers in metal conductor pipes, which shall be continually maintained in such condition that leaks therein will not cause the water to soak into the walls or any other part of the building.

Sec. 612. (**Cornices.—Gutters.—Eaves.—Parapets.—Bay Windows.**)—Where sheet metal cornices or external metal sheet gutters are used, their entire framework and covering shall be of metal, and the walls shall extend behind all such cornices or gutters along their entire height. All metal work in and about any cornice, gutter, eave or parapet, or in or about any bay, or oriel window, shall be supported by suitable brackets placed not more than four feet apart and firmly secured to the wall. Wood shall not be used as the support of any gutter or cornice for buildings of one hundred feet or more in height.

Sec. 613. (**Towers.—Domes and Spires.—Construction Of.**)—Towers, domes and spires may be built on top of the roofs of buildings, but shall not occupy more than one-fourth of the street frontage of any building. Such towers, domes or spires, if any part thereof is built to a height of more than sixty feet and less than ninety feet, shall be of slow-burning construction, and if of greater height than ninety feet above the sidewalk shall be of fireproof construction; and in all cases where the area of such spire, dome or tower exceeds one hundred square feet, its supports shall be carried down to the ground, and shall be, if the construction supported is more than sixty feet and less than ninety feet high, of slow-burning construction, and if more than ninety feet high, of fireproof construction.

Sec. 614. (**Skylights.—Construction Of.—Glass In.**)—Any skylight on the roof of any building, other than a frame building, shall have the sides, sashes and frames constructed of metal; or of wood, metal clad on all exterior surfaces.

The glass in all such skylights, except in buildings of Classes III. and VI. not exceeding three stories in height shall have at least six inches over same, a strong wire netting (wire not lighter than No. 8 and mesh not coarser than one and one-half inch by one and one-half inch), unless the glass contains a wire netting within itself.

Sec. 615. (**Porches.—Verandas.—Porticos.—Balconies.—Construction of Inside Fire Limits.**)—If verandas, porches or porticos are enclosed, the enclosing walls shall be made of incombustible material, the only exception being in case such porticos or verandas are to be made part of a storm house or of a storm door enclosure, which, however, shall in no case be more than twelve feet high, nor shall it occupy a greater frontage than two feet more than the width of the inner doors for which the storm doors are made.

Sec. 616.—(**Sidewalks.—Occupation of by Parts of Buildings.**)—The use of any part of the sidewalks for steps or for open areas is prohibited.

Sec. 617. (**Chimneys.—Walls Of.—Height Above Roof.**)—Amended June 5, 1906, to read as follows:

No chimney shall be built with less than four inches thick brick wall, and no chimney having a greater flue area than two hundred and sixty square inches shall have walls less than eight inches thick; provided that in all cases where chimneys are built with walls less than eight inches thick the same shall have flue liners of fire clay or terra cotta in their entire length. Except that where flues are to be used for gas grates or gas ranges, the flue lining may be omitted, but the inside of the flue shall be smoothly plastered. Chimneys that are built of fireproof composition composed of cinders, cement and burnt sand shall be no less than two and one-half (2½) inches thick, and perfectly smooth. Chimneys that are built of fireproof composition shall be built in two sections capable of being shoved into one another where it touches the roof; the flue hole of the base stone must be much larger than the lower part of the chimney, so that the said base stone incases the lower portion of the chimney, and both can move independent without cracking a joint in a section; there being an air space or a cooler between the flue hole of the base stone and the lower portion of the chimney. It is not necessary that this chimney should be lined with fire clay or terra cotta, as it is itself a fireproof composition. The use of unprotected metal flues inside of buildings will not be permitted.

Every chimney having an area of not more than two hundred and sixty square inches shall be carried up to at least five feet above the highest part of the roof of

the building of which such chimney is a part, if such roof is a flat roof. If the roof is a pitched roof the chimney shall be carried up at least two feet above the highest point of same.

Sec. 618. (**Chimneys.—Interior.—Walls Of.**)—Chimneys having a greater flue area than six hundred square inches shall, if built of brick, have surrounding walls of at least sixteen inches of brick work, and such walls shall be built hollow with at least four inches hollow space in such walls, at a height of fifty feet above smoke inlet the thickness of the surrounding brick work may be reduced to twelve inches, but in all cases the surrounding walls of chimneys of this or any other size shall be so proportioned that the brick work in same will not be subjected to a greater stress than elsewhere herein fixed as a maximum safe stress for brickwork. For chimneys having a greater flue area than one thousand six hundred square inches the thickness of walls shall be increased above the thickness above specified, four inches for each increase of one thousand square inches or fractional part thereof.

Sec. 619. (**Chimneys or Flues.—Height above Roof.**)—All flues having a greater area than two hundred and fifty square inches, and not more than six hundred square inches, shall be carried up at least twelve feet above the highest point of roof or building of which they form part; and all flues having a greater area than six hundred square inches and not more than nine hundred square inches, shall be carried up at least twenty feet above highest point of roof. All chimneys having a greater area than nine hundred square inches shall be carried to a height of at least twelve feet above any roof within a radius of sixty feet; provided that the top of the chimney shall be not less than twenty feet above the highest point of the roof of the building of which it forms a part.

Sec. 620. (**Chimneys or Flues.—Linings Of.**)—All flues having a greater area than four hundred square inches shall be lined on the inside with insulating material, which lining shall start at least two feet below the smoke inlet, and for flues having an area of from four hundred to six hundred square inches shall extend twelve feet above smoke inlet, and for all flues of more than six hundred square inches, and not more than one thousand six hundred square inches, shall extend twenty feet above smoke inlet, and for all flues having a greater area than one thousand six hundred square inches, shall extend at least thirty feet above smoke inlet. If an internal smoke pipe of metal is used, so much of the brick work as is inside of the insulating cavity of the stack may be omitted. Metal smoke-stacks shall, however, be lined with insulating material for at least thirty feet of their height.

If internal stacks in buildings be made of metal then they shall be entirely surrounded within the building with a fireproof material which shall thoroughly protect the building from fire, and there shall be an air space, not less than four inches in the smallest part between the fireproofing and the metal stack.

Sec. 621. (**Chimneys.—Interior.—Framing Around.**)—No joists or girders shall rest and be supported on the walls of any chimney, and the framing around chimneys of all kinds shall be so constructed that in no case will any joists or timbers be placed nearer than two inches from the outside face of walls of flues, and in no case shall the distance from the inside of any flue to any joists or timbers be less than seven inches.

The foregoing shall apply only to chimneys which are enclosed by, or form part of, the interior of any building.

Sec. 622. (**Chimneys.—External.—Location Of.—Built of Iron or Steel.**)—Chimneys may be built outside of the walls of existing buildings (but not in such manner as to encroach upon any street or alley), and shall be built as follows:

If at least one side of such chimney abuts entirely upon the wall of an existing building and the chimney is throughout its entire length securely and firmly anchored to the walls of such existing building, the wall of such chimney may be built of hollow tiles, in which case, however, it shall have a cast iron base, lined with fire brick, and extending to a height of at least ten feet above the street or alley grade.

Such external chimney may also be built of rolled steel or iron not less than one-fourth inch in thickness, and lined with insulating material, laid in fire clay, for at least thirty feet above street or alley grade, or it may be built throughout its entire height of cast iron, in which case the first ten feet above street or alley grade shall be lined with insulating material; provided, however, that in chimneys not exceeding five hundred square inches in flue area, the upper twenty-five feet may be constructed of steel or iron not less than one-eighth inch thick.

Sec. 623. (**Chimneys.—Isolated.**)—Isolated chimneys shall be so designed and constructed that the stress upon any part thereof, due from the weight of the stack itself and from wind pressure, shall never exceed the safe limits as provided in this chapter.

Sec. 624. (**Chimneys or Smokestacks.—Foundation Of.**)—The foundations of chimneys or smoke-stacks, whether inside or outside of buildings, or whether connected with the same or isolated, shall be designed and built in conformity with the provisions relating to foundations of buildings hereinbefore given.

Sec. 625. (**Smoke Flues Passing Through Partitions.—Woodwork Around.**)—Where smoke flues of diameter of six inches or less pass horizontally through a wood or a plastered stud partition, they shall be surrounded by a ventilated thimble of incombustible material.

Where a smoke flue of a greater diameter than six (6) inches passes through a wood or plastered stud partition, it shall be surrounded either by a body of brick, hollow tile, porous terra cotta or other incombustible substance, measuring at least eight (8) inches all around such smoke flue. Smoke flues of less diameter than twelve inches shall be kept at least twelve inches distant from any combustible partition, ceiling or floor, and such woodwork immediately over and for a distance of two feet on each side of such smoke flue shall be covered with sheet metal or with porous terra cotta, hollow tile or with plaster.

Smoke flues of greater diameter than twelve inches and less area than six square feet, shall be kept at least twenty inches away from any woodwork, and such wood-work shall be protected as before specified for the smaller smoke flues to a distance of four feet on each side of such smoke flues.

Wherever smoke flues of larger area than six square feet are used they shall be kept at least three feet distant from any woodwork, and such woodwork for a distance of at least six feet on either side of such smoke flues shall be protected as before specified for smaller flues.

Sec. 626. (**Floors.—Protection Of.—Around Boilers, Furnaces, Etc.**)—Wherever steam boilers or furnaces or ovens, coffee roasters or other structures in which fires are maintained, are set inside of a building, or in a room with wooden floor or ceiling construction, the floor of the same shall be protected by a covering of brick or concrete not less than five inches thick set in mortar upon a continuous sheet metal bearing plate not less than three-sixteenths of an inch thick, all the joints of which are to be securely riveted, and the edges of which are to be turned up five inches all around. This foundation of sheet metal and brick and concrete shall extend under the whole of the fire box and ash pit of such steam boiler or furnace or other structure, and to a distance of not less than ten feet in front and at least four feet on the other three sides of same.

Sec. 627. (**Ceiling.—Protection Of.—Around Boilers, Furnaces, Etc.**)—The space between the tops of such steam boiler or furnaces and any wood ceiling construction shall in no case be less than three feet, unless such boiler be a low pressure boiler, in which case such space shall be not less than eighteen inches, and the under side of such wood ceiling construction shall in all cases be protected either by three coats of plastering or metallic lath or wire netting, or at least two inches of porous terra cotta plastered on the under side, or by a covering of hollow tile with two air spaces at least one-half inch each between the wood and the under surface thereof, which under surface shall also be covered with a heavy coat of plastering.

Sec. 628. (**Boilers.—Location Of.—Permit For.**)—In all cases boilers shall be so placed as to give ample room between any ceiling, wall or partition to connect or operate any valves or pipes or other connections used on such steam boilers, and in buildings of 4,000 or more square feet in area, the size, number and location shall be marked on the plans before a permit is issued by the Building Department.

Sec. 629. (**Cupolas of Foundries.**)—Cupolas of foundries shall extend at least ten feet above the highest point of any roof within a radius of forty feet of such cupola, and shall be covered on top with wire netting.

Sec. 630. (**Pipes for Distribution of Hot Air.—Registers.**)—Where pipes are used for the distribution of hot air from a hot air furnace, such pipes shall be made of metal and shall be double. The space between the two metal pipes shall be at least one-half inch. Such pipes are to be made with air tight joints and to be securely fastened to the partitions through which they pass.

The openings in floors for hot air registers shall be surrounded with borders of incombustible material not less than two inches wide, and firmly and securely set in place. The register boxes shall be double, the distance between the two thicknesses of tin being at least one inch.

Sec. 631. (**Pipes, Ducts and Registers.—Material For.**)—Where the air conveyed through pipes is heated in an ordinary hot-air furnace, or in any other apparatus by direct contact of the air with a fire box, the material used for these double ducts, pipes and register boxes shall be bright tin, and the joints shall be double-

seamed, but not soldered. Where the air is heated by contact with hot water or steam pipes, any other sheet metal may be used for the pipes, and the use of double pipes is not obligatory.

Sec. 632. (**Doors and Windows.—When Required to Be Closed.—Fire Resisting Glass.**)—Wherever the distance between doors and windows in buildings of Classes I., II., IV., V., VII. and VIII., on opposite sides of alleys or courts shall be less than thirty feet, or wherever the distance between such doors and windows and any inside lot line of any lot upon which any such building is erected is less than fifteen feet, or wherever the distance between such doors and windows and the alley line (where the alley is less than thirty feet wide) is less than fifteen feet, such windows and the glazed portion of such doors shall be made of fire-resisting glass, set in frames of incombustible material.

Where the windows in buildings of Class I. on lot line courts are less than two feet from the lot line the sashes shall be stationary.

The provisions of this section shall not apply to frame buildings of any class.

As amended by ordinance of October 22, 1906.

This section shall not apply to buildings of Class I., one story in height and having a floor area of less than twelve hundred and fifty square feet, nor shall it apply to buildings of Class II., not more than two stories in height.

As amended by ordinance of February 18, 1907.

Sec. 633. (**Class of Building Not to Be Changed Without Conforming to Provisions of This Ordinance.**)—If buildings, the uses of which bring them within any of the classes mentioned in this chapter are to be applied to the uses of any other class for which a better system of construction is called for by this chapter, the construction and equipment of such buildings shall first be made to conform to the requirements of this chapter as specified for their intended use. And it shall be unlawful to apply any such building to a new or different use than that to which its structure and equipment adapts it under this chapter, unless the requirements of this chapter for such new or different use shall first have been complied with, and a permit for such alteration of use shall have been first obtained from the Commissioner of Buildings.

Sec. 634. (**Alteration of Existing Buildings.**)—Amended by ordinance Feb. 3, 1908, to read as follows:

Nothing in this chapter contained shall be considered as requiring alterations in the construction or equipment of buildings in existence at the time of the passage of this chapter, unless such buildings shall not have sufficient or adequate means of egress therefrom or ingress thereto by reason of insufficient or inadequate stairways, or stairways improperly located, or insufficient or inadequate elevators or elevator equipment, doors, fire-escapes, windows or other means of egress or ingress.

Whenever an Inspector of Buildings shall make a report to the Commissioner of Buildings that any such building has inadequate or insufficient means of egress therefrom or ingress thereto, as aforesaid, he shall notify the owner, agent, or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building as are necessary to be made in order to promote the safety of the occupants of such building, and of the person using the same, and of the public.

If, however, it is desired to enlarge, or in any manner materially modify the construction of any existing building, or to make change in its use or occupation which will transfer it from one class as recognized by this chapter to another class, then before such enlargement or structural change or modification of building is made, or before such change in its use or occupation may be made, the entire building shall be reconstructed or modified in such manner as to bring the same, when enlarged or altered, or when occupied for its new and different purposes, in accordance with the provisions of this chapter.

Sec. 635. (**Walls of Altered Buildings.—Increasing Thickness Of.**)—If the walls of a building are not of sufficient thickness to comply with the requirements of this chapter for an enlarged or modified building, then the thickness of the existing walls shall be increased by building alongside of them a new wall, which shall not, however, be less in any part thereof than twelve inches thick, and which shall be increased in thickness by four inches for at least every forty feet in the height of such wall. Such new wall shall be laid in Portland cement mortar and shall be anchored to the old wall (bonding with brick or masonry will not be considered as complying with this chapter); and if an increase in the height of the building is contemplated, the wall from the top of the old wall shall be built jointly upon the new and old walls. If solid masonry buttresses are introduced in connection with such thickening and strengthening of existing walls, the intervening wall may be reduced to eight inches in thickness, provided such buttresses are sufficient in number and in area to make the resultant structure of equal strength with the solid wall already specified. Provided, however, that steel or iron columns or beams

may be used instead of such new wall, such columns or beams to be bolted or bonded to the existing wall in a manner satisfactory to and approved by the Commissioner of Buildings.

Sec. 636. (**Walls.—Party.**)—The provisions of the preceding section shall also apply to all cases where existing party walls are to be joined to for the erection of new buildings. But in the case of party walls, which at the time of their erection were built in accordance with the terms of the city ordinances then in force, such walls, if sound and in good condition, may be used without increase of thickness for any building not higher than and of the same class as the building for which the original wall was built.

Sec. 637. (**Walls.—Erection Of.—Walls and Skeleton Framework Securely Braced.**)—In the erection of buildings of masonry construction, no wall shall be carried up at any time more than two stories above another wall of the same building. The walls and skeleton framework of all buildings shall be kept securely braced and otherwise protected against the effects of the weather during all building operations.

Sec. 638. (**Tanks on Roofs.—Permits.—Fees.**)—It shall be unlawful for any person to construct, maintain, or to allow or permit to remain, in or upon the roof of any building in the city, any water tank of a larger capacity than four hundred gallons, unless such tank shall rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron girders set on steel plates, which rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron or steel construction; provided, however, that no water tank of a capacity exceeding four hundred gallons shall be constructed in or upon any building *without first submitting to this department a complete set of plans, showing the construction in detail of the supports and foundation of the tank; said plans are to be approved by the Department of Buildings, and a permit is to be taken out by the contractor for the substructure, for which permit a fee of five (\$5) dollars shall be charged.*

Amended Nov. 25, 1907.

Sec. 639. (**Stairs and Fire Escapes.—Obstruction Of.**)—It shall be unlawful under any circumstances to close up or obstruct during the occupation for business purposes of any building, the stairways or fire escapes or the approaches leading thereto, and no change in the position or construction of any such stairway or fire escape shall be made, unless the permission so to do of the Building Department first shall have been obtained.

ARTICLE XVII.

FRAME BUILDINGS.

Sec. 640. (**Permits for Raising or Altering Buildings.—Requirements.**)—Permits to alter or raise frame buildings shall be given, provided they do not involve an enlargement or raising of such buildings beyond the limits of dimensions herein prescribed for frame buildings, and if the stresses upon the material thereof are kept within the safe limit of stresses herein prescribed in this chapter, and if, further, such frame building has not been damaged to any extent greater than fifty per cent of its original value by fire, wear and tear, and action of the elements or otherwise. Provided, however, where any frame building is raised for the purpose of erecting a basement story under the same, the walls inclosing such basement shall be of masonry.

Sec. 641. (**Strength of Timber Constructions.—Outside of Fire Limits.**)—The provisions of this chapter as to the strength and stability of timber constructions shall also apply to the construction of frame buildings outside of the fire limits.

Sec. 642. (**Frame Buildings Prohibited.—Exception.**)—Hereafter no frame building shall be erected within the fire limits of the city, except where express provision is made in this chapter therefor.

Outside of the fire limits it shall be lawful to erect frame buildings not exceeding forty feet in height from the sidewalk to the highest point of roof. If such frame buildings have a basement story of masonry, their height above the sidewalk may be made not to exceed forty-five feet.

Sec. 643. (**Frame Buildings Inside Fire Limits.—Altered or Enlarged.**)—No existing frame buildings inside the fire limits shall be altered or enlarged beyond the limit of height and dimensions described in Sections 642 and 646 of this chapter.

Sec. 644. (**Frame Buildings Inside the Fire Limits Changed Into Flat Buildings.—Fire Walls.**)—Whenever any frame building inside the fire limits shall be remodeled, altered or changed for the purpose of using the same for flats or apartments, or whenever such frame building shall be occupied for flat or apartment purposes, each suite of apartments in such building shall be separated from every other suite of apartments in such building by a wall of incombustible material, of such dimensions and thickness as required by this chapter.

Sec. 645. (**Frame Buildings.—Raising.—Requirements.—Changing Gable or Hip Roofs to Flat Roofs.**)—Permission may be granted by the Commissioner of Buildings for the raising of existing frame buildings, whether within or without the fire limits, to the limits of height hereinbefore fixed for new frame buildings, and no more. The Commissioner of Buildings is also authorized to issue permits for changing gable or hip roofs of existing frame buildings to flat roofs, and for the raising of walls incident to such change. But if such hip or gable roof is changed to a flat roof and the walls raised in connection with such change, the total cubic contents included by the walls so raised and the roofs so altered shall not exceed the cubic contents originally included in such gable or hip roofs.

Sec. 646. (**Frame Buildings.—Damaged.—Repairing.—Limitations.**)—It shall not be lawful to repair or reconstruct or remove any frame building which has been injured more than fifty per cent of its original cost by wear and tear, by the effects of the elements or by fire.

Sec. 647. (**Lot Lines.—Requirements as to.—Number.—Dimensions.**)—Frame buildings shall not be built nearer than one foot to any line of the lot upon which they are built, street and alley lines excepted. It shall not be lawful to erect a frame building wider than forty feet nor deeper than seventy feet, unless such building be divided by a fire wall or fire walls, built of incombustible material and of a thickness to be approved by the Commissioner of Buildings, so that no more than two thousand eight hundred square feet of superficial area shall be contained in any section or part of such building, uninclosed by such fire wall. If more than one frame building is built in the direction of the depth of any one lot, such buildings shall not be built with a less distance than ten feet between them.

Sec. 648. (**Chimneys in Frame Buildings.—Chimney Flues Through Partitions.**)—Chimneys in frame buildings shall be built of brick, or of hollow tile, with a double tile wall around the smoke duct; all joints, whether in tile or in brick chimneys, shall be well filled with mortar and neatly pointed on the outside. Brick chimneys shall have flue linings of fire clay on the inside where the inclosing walls are less than eight inches thick. The wood framing of frame buildings shall be trimmed around chimneys in such manner as not to come within two inches of the same.

Metal smoke pipes or tile flues of single thickness shall not extend through the floors or through the ceiling or roof of any building; and where such smoke pipes or tile flues pass through partitions the woodwork of such partitions shall be protected either by a course of brick built all around such smoke pipes or tile flues, or by a thimble made of bright tin, the two rings thereof being at least three inches apart, with proper ventilating holes provided in the outer covering of the same on both sides of the partitions.

Sec. 649. (**Frame Buildings Carried to Uniform Height.**)—Frame buildings, the different parts of which are of different heights, may be carried up to a uniform height, provided the greatest height thereof does not exceed the limits of height prescribed in this chapter for frame buildings.

Sec. 650. (**Basement or Story Placed Beneath Frame Buildings.**)—A frame building may be raised for the purpose of erecting a basement or story, or both, thereunder, but the principal floor of such frame building shall not be raised to a higher level than sixteen feet above the sidewalk grade of the sidewalk upon which such premises abut. The walls inclosing such basement or story shall be of masonry and not less than twelve inches thick, excepting that when a one-story frame building is raised and has a basement only built thereunder the masonry wall of such basement may be eight (8) inches thick above grade and twelve (12) inches thick below. The foundations of such walls shall be constructed as provided in this chapter. Provided, however, that no frame building shall be raised for the purpose of constructing a basement or story, or both, under the same to a greater height to the top of its roof than that elsewhere herein given as the maximum height above grade for frame buildings. The thicknesses of walls hereinabove required shall also apply to new frame buildings.

Sec. 651. (**Sheds.—Frame.—Requirements.**)—Sheds not exceeding fourteen feet in height from the ground at the highest point thereof, and not exceeding three hundred feet in area, with an incombustible roof, may be constructed of wood within the fire limits. Such sheds shall not be located on the front part of any lot, nor shall they be used as a dwelling or as an addition to a dwelling house, or for any business purpose whatever, nor shall more than one shed be erected on any one building lot of twenty-five feet in width.

Sec. 652. (**Sheds.—Open Shelter.—Height of Walls and Foundation.—Enclosed.—Inside Fire Limits.**)—Amended by ordinance Nov. 25, 1907, to read as follows:

Open shelter sheds not exceeding eight hundred square feet in area may be erected within the fire limits, provided they have roofs of incombustible material and the highest point is not over fifteen feet above the ground, and that the roofing be supported on sufficient posts or piers. Such sheds shall have no combustible enclosing walls or wooden

floors, provided that a floor of two-inch planking laid directly upon the ground may be used. Such sheds shall only be erected upon the rear of the lot, and not more than one such shelter shed or any other shed shall be erected on any lot of twenty-five feet in width.

If it is desired to enclose an open shelter shed, the enclosing walls shall be made of brick, hollow tile, or other incombustible material, and such walls shall have foundations extending to solid ground and at least four feet below the surface of the ground.

Open shelter sheds may be erected outside the fire limits not to exceed twenty-eight hundred square feet in area and subject to the approval of the Commissioner of Buildings.

Sec. 653. (Sheds.—Coal, Brick and Salt Sheds along Railroad Tracks and Navigable Streams.)—Amended by ordinance of June 3, 1907, to read as follows:

That open shelter sheds to be used for the storage or handling of coal, brick or salt may be erected within the fire limits, upon, along or adjacent to steam railroad tracks or along navigable waters; provided such sheds shall have incombustible roofing and shall not exceed thirty-five feet in height from the ground to the highest point of the roofing. If it is desired or intended to enclose any such sheds, enclosing walls thereof shall be covered with incombustible material. No such coal or salt sheds shall be built upon any lot or parcel of ground fronting upon any street within seventy-five feet of any building used exclusively for residence purposes, unless the consent of the owners of the majority of the frontage on both sides of such street between the two nearest intersecting cross streets shall have first been obtained by the person or corporation desiring to erect and maintain such coal or salt shed.

Sec. 654. (Lumber or Junk Yards.—Lumber or Junk Not to Be Piled Near Residences Except by Consent.)—No person or corporation shall establish, maintain, conduct or operate any lumber yard or place at, upon or in which new or second-hand lumber is kept for sale or is stored for seasoning or drying, or where old iron or junk is kept or stored on any premises fronting on any street in any block where two-thirds of the buildings on any street bounding any such block are used exclusively for residence purposes, unless the written consent of the owners of a majority of the frontage on both sides of all the streets bounding the block in which it is proposed to locate, establish, conduct or maintain such lumber yard or place be first obtained by the person or corporation desiring to establish, maintain or operate such lumber yard or place consenting to the issuance of a license for the establishment, keeping or maintenance of such lumber yard or place; and such written consents shall accompany the application for a license made by such person or corporation.

Sec. 655. (Lumber Not to Be Piled Near Planing Mills, Woodworking Establishments or Private Residences.)

Amended by ordinance of January 2, 1907, to read as follows:

No lumber shall be piled for the purpose of storage, seasoning or drying the same, within fifty feet of any planing mill or wood working manufactory, nor within one hundred feet of any private residence, unless the same has been erected since the establishment of such yard.

Sec. 656. (Grand Stands.—Frame.—Within the Fire Limits.—Frontage Consents.)—Wooden grand stands or tiers of seats commonly known and described as grand stands, may be erected within the fire limits where no part of any such structure shall be within sixty feet of any other building or structure, provided that the person or corporation desiring a permit for the construction of such a grand stand shall first obtain the consent in writing of the owners of a majority of the frontage on both sides of the street or streets on each side of the block or square in which it is desired to erect such grand stand.

Sec. 657. (Ice Houses.)—Amended March 19, 1906, to read as follows:

Houses to be used exclusively for the storage of ice may be constructed within the fire limits of wood with incombustible roofing, the walls to be inclosed with an envelope of incombustible material; eight-inch brick or tile or approved cement concrete walls, with proper foundations of masonry, shall be used for such envelopes, and such houses shall be used for no other purposes than the storage of ice.

Provided, however, houses to be used exclusively for the storage of ice, may be erected and maintained contiguous with any lake, and six hundred feet from any other building, except buildings used in connection with the conduct of said business, outside of the fire limits, may be constructed of frame, with incombustible roofing, and may have a floor area of not to exceed 80,000 square feet.

Houses to be used exclusively for the storage of ice may be constructed of frame, with incombustible roofing, outside of the fire limits, of greater floor area than 80,000 square feet, provided that building is divided by a solid wall of masonry for each additional 80,000 square feet of floor area, or fractional part thereof, said wall to be approved by the Building Department, and to extend one foot beyond the enclosure of said building on each end.

Houses to be used exclusively for the storage of ice, built contiguous with railroad tracks, and not within one hundred feet of any other building, outside of the fire limits, may be constructed of frame, with incombustible roofing, with a floor area of not to exceed 5,000 square feet.

Houses to be used exclusively for the storage of ice, contiguous with railroad tracks and not within one hundred feet of any other building, outside the fire limits, may be constructed of frame, with incombustible roofing, of a larger area than 5,000 square feet, provided that building is divided by a solid wall of masonry for each additional 5,000 feet of floor area, or fractional part thereof, said wall to be approved by the Building Department, and to extend at least one foot beyond the enclosure of said building on each end.

All dividing walls must extend through and above the roof of any building in which they are built to a distance of three feet and must be covered with incombustible coping. No dividing wall shall be of less thickness than 12 inches at any point thereof.

ARTICLE XVIII.

ELEVATORS AND HOISTWAYS.

Sec. 658. (Elevators, Passenger and Freight.—Permit for Construction.—Fee.)—Before proceeding with the construction of any passenger or freight elevator, except such as are hereinafter specially exempted from the provisions of this chapter, there shall be obtained from the Commissioner of Buildings by the owner or agent of the building in which such elevator is to be constructed or by the contractor who is about to construct such elevator a permit for such construction, and it shall be unlawful for any such owner, agent or contractor to permit or allow the construction of any such elevator, or to proceed with, or in or about any of the work of construction of any such elevator until such permit shall first have been obtained. Such permit shall be issued by the Commissioner of Buildings after application shall have been made to him in writing therefor by any such owner, agent or contractor, specifying the number and kind of elevators which it is desired to construct and the location of the building or structure in which the same is or are to be placed, such application shall be accompanied with such plans and specifications as may be necessary to advise and inform said Commissioner of the plan of construction, type of elevator and location thereof. If such plans and specifications shall show that such elevator or elevators is or are to be constructed or erected in conformity with the provisions of this chapter, the Commissioner shall approve the same and shall issue a permit to such applicant upon the payment by such applicant of a fee of two dollars for each elevator to be constructed and erected, and such fee shall be known as a construction fee, and shall not be held to cover the cost of any inspection which shall at any time thereafter be made of such elevator or elevators when constructed or any of the equipment thereof.

Any person, either as owner or agent of any building or structure in which any elevator or elevators is or are to be constructed, or any contractor engaged in erecting or constructing such elevator or elevators, who shall allow to be erected or constructed, or who shall attempt to erect or construct any elevator or elevators in any building or structure, without having previously obtained the permit herein required, and without having complied with the provisions of this section, shall be fined not less than fifty nor more than two hundred dollars for each offense.

Sec. 659. (Testing of Safety Devices.)—Every passenger or freight elevator hereafter constructed (except such as are hereinafter excepted from the provisions of this chapter) in any building within the city shall be provided with some efficient device to secure the safe operation of such passenger or freight elevator in its running up or down, and such device shall be subjected to such practical test as may be determined by the Commissioner of Buildings to ascertain the efficiency of such safety device to properly perform the service for which it is intended; and it shall be the duty of the Commissioner of Buildings to cause to be made such test of each and every device upon any such elevator hereafter constructed, and no such elevator hereafter constructed shall be permitted to run until the inspection herein provided for has been made and a certificate issued by the Commissioner of Buildings or such inspector that the same has been inspected, and the certificate shall be posted in a conspicuous place in such elevator. Every passenger or freight elevator now in operation within the city shall be provided with some efficient device to procure the safe operation of such passenger or freight elevator in its running up and down, and such device shall be subjected to the same test as is herein provided for elevators to be hereafter constructed, and a certificate of such inspection issued as provided for elevators to be hereafter constructed, and every such elevator now in operation within the city, or which may hereafter be constructed and operated in the city, shall be inspected under and by authority of the Commissioner of Buildings at least once every six months. Every owner or agent of any building who fails to comply with any pro-

vision of this section shall be fined not less than fifty dollars nor more than two hundred dollars for each offense, and every owner or agent of any building wherein any passenger or freight elevators are situated in the city who refuses to permit the inspection of any such elevator or who refuses to permit the making of the test in this section provided, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each and every day on which such elevator runs or is operated on and after the date of the refusal to permit inspection of such elevator or the refusal to allow such test to be made.

Sec. 660. (**Safety Devices.—Further.**)—Every passenger or freight elevator now running or operating within the city, or which may hereafter be constructed and run and operated, shall be provided with some efficient device for the purpose of preventing the cab or car of such elevator from falling, or the securing of the safety of the cab or car and its load, in case it does fall, and all such devices that are applied to such passenger or freight elevator for the purpose of preventing such cab or car from falling or for stopping it in case it does fall shall be subjected to a practical test, such test to be made under the supervision of the Commissioner of Buildings, to determine the efficiency of such device and to secure the safety of the cab or car and its contents. Every person, whether owner or agent of any building wherein any such passenger or freight elevator within the city is now run or operated, or which may hereafter be constructed or operated, who shall fail or neglect to provide such passenger or freight elevator with such device for the purpose of preventing the cab or car from falling, or the securing of the safety of the cab or car in case it does fall, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each and every day on which such elevator is run or operated without being provided with such device.

Sec. 661. (**Tests.—Owner Must Permit.**)—Any owner or agent of any building wherein any passenger or freight elevator is run or operated within the city who desires to have a test made by and under the authority of the Commissioner of Buildings as to whether such elevator is provided with sufficient and proper safety devices shall or may notify said Commissioner of Buildings in writing that such a test is desired; and the time when such test may be made, which shall not be less than two nor more than ten days after such notice is given to the Commissioner of Buildings; and it shall be the duty of every owner or agent of any such building wherein any such passenger or freight elevator is run or operated in the city, or which may hereafter be constructed and operated, to permit the making of the test of such devices upon demand being made by the Commissioner of Buildings or by a duly authorized inspector, and every owner or agent of any such building wherein any such passenger or freight elevator is run or operated, or which may be hereafter constructed and operated, who refuses to permit the test of such devices to be made upon demand of said Commissioner of Buildings or Elevator Inspector, within five days from and after such demand is made, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each and every day on which such passenger or freight elevator is run or operated after such demand for and refusal of the making of such test.

Sec. 662. (**Certificate to Be Furnished and Posted.**)—Whenever any such elevator shall have been inspected and the tests herein required shall have been made of all safety devices with which such elevator is required to be equipped, if the result of such inspection and tests shall show such elevator to be in good condition, satisfactory to the Commissioner of Buildings or the Inspector of Elevators, and that such safety devices have been provided, in accordance with the requirements of this chapter, and are in good working condition and in good repair, it shall be the duty of the Commissioner of Buildings or Inspector of Elevators to issue or cause to be issued, upon the payment of the inspection fee required by the provisions of this chapter, a certificate setting forth the result of such inspection and tests, and whether such elevator and its equipment is in safe condition and in good working order. Such certificates shall be furnished to the owner or agent of the building wherein such elevator is operated, and shall be posted by such owner or agent in a conspicuous place in such elevator.

If the result of such inspection or tests shall show such elevator not to be in safe condition or not to be in a condition of good repair, or shall show that such devices, or any of them, have not been furnished, or, if furnished, are not in good working order or in a good condition of repair, such certificate shall not be issued until such elevator and its equipment or such safety device or devices shall have been put in good working order and in a good condition of repair, satisfactory to the Commissioner of Buildings or the Inspector of Elevators.

In any event, however, the inspection fees herein required shall be paid either at the time application is made for inspection or upon the completion of such inspection and tests.

Sec. 663. (**Tests to Be Made Semi-annually.**)—It shall be the duty of the Commissioner of Buildings to cause the tests to be made as provided for in Sections 659, 660 and 661 of this chapter of each passenger and freight elevator in the city at least once in every six months from and after the issuance of the first certificate.

Sec. 664. (**Inspectors.—Duties Of.—Power of Commissioner to Shut Down Elevators.**)—Whenever any inspector of any passenger or freight elevator finds any of the running parts or automatic devices, or other equipment out of order or in an unsafe condition he shall immediately report the same to the Commissioner of Buildings, together with a statement of all the facts relating to the condition of such elevator or elevators.

It shall be the duty of the Commissioner of Buildings, upon receiving a report from any inspector of the unsafe condition of any elevator, to order and cause such elevator to be stopped from use until the same shall have been placed in a safe condition, and any owner or agent of any building wherein any such passenger or freight elevator is run or operated within the city who permits or allows any such elevator to run after the receipt of a notice, in writing, from the Commissioner of Buildings that any such elevator is out of order, or is in an unsafe condition, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each and every day on which such elevator is run or operated without being put in a safe condition or placed in good order.

Sec. 665. (**Device.—Efficient.—To Be Approved.**)—Any device which shall prove efficient for the purposes hereinbefore described in this chapter shall be approved by the Commissioner of Buildings, if, after a test by said Commissioner or any of his Elevator Inspectors, it is found that such device or devices satisfactorily performs the work it is intended should be performed by such device or devices in and by the provisions of this chapter.

Sec. 666. (**Inspections to Be Made at the Same Time.—One Fee.**)—All certificates for and inspections of hoistways and elevators provided for in this article shall be made at the same time and the fee required to be paid by Section 668 of this chapter shall include the cost of all such inspections and issuance of such certificates.

Sec. 667. (**Elevators Not Required to Be Equipped with Safety Devices.**)—The provisions of this chapter requiring the equipment of elevators with safety devices shall not apply to any elevator or elevators in any private residence not more than three stories in height, nor to any hand hoists, elevator or hoist used solely for hoisting materials or tools in any building in course of construction.

For the purposes of this section, flat or apartment buildings shall not be held to be private residences, and any elevator or elevators operated in such flat or apartment buildings shall be equipped with safety devices in accordance with the provisions of this chapter.

Sec. 668. (**Inspections.—Fees.**)—The owners, agents or occupants of any building in which an elevator is used shall pay to the City Collector, before a certificate of inspection is issued, a fee of two dollars for each inspection of each elevator made in pursuance of the provisions of this chapter.

Sec. 669. (**Certificates of Inspection.—Construction.—Details Of.**)—When an Inspector finds a hoistway, door, shaft and elevator and its equipment, including safety devices, in a sound and safe condition, he shall make and deliver to the owner, or to his agent, a certificate signed by the Commissioner, which shall contain the date of inspection, the condition of the elevator at that date, the weight it may safely carry, and a statement that the shaft, doors and all equipments, including safety devices, are constructed in a safe and proper manner and are constructed in accordance with the provisions of this chapter, which certificate shall be by the owner of the elevator framed and put in some conspicuous place in such elevator for examination by the public; provided, that the words "safe condition" in this section shall mean that it is safe for any load up to the amount of weight named in such certificate.

Sec. 670. (**Hatch.—Doors.—Freight Elevators.**)—It shall be lawful for elevators used exclusively as freight elevators to be without inclosing walls, but in all such cases there shall be at every floor through which such freight elevators pass automatic hatch closers or automatic doors, made in such manner that they will fully close each well hole when the temperature in such well hole exceeds one hundred and forty degrees Fahrenheit; and it shall be the duty of the owner, agent or person in possession, charge or control of the building in which such elevator or elevators is or are maintained to keep such hatch closers or doors at all times in good working order, and any such owner, agent or person failing to do so shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense.

Before any doors shall be considered as complying with the provisions of this section they shall be examined by the Commissioner of Buildings and the Fire Mar-

shal, and if it be found by such officials that such doors will automatically close when the temperature at or near the same exceeds one hundred and forty degrees Fahrenheit, and that also the conditions of construction and operation of such doors or hatch closers are such that there is no reasonable probability of their getting out of order and failing to operate when required, and if there is nothing in their construction or operation that is likely to cause accidents to or interference with the elevator service in the hatch holes which they are intended to close, then, and in such case only, shall the use of such hatch closers or doors be permitted.

But such automatic hatch closers or doors shall only be permitted in cases where the building in which such freight elevator is in use shall be equipped with stairways, or stairways and passenger elevators, sufficient to afford ample means of escape from such building in case of fire for all persons employed or for all persons in such building, and in buildings not so equipped such freight elevators shall be inclosed in fireproof walls, as hereinafter required.

Provided, that all freight elevators herein specified shall be either inclosed in fireproof walls, as hereinafter required, or equipped with automatic hatch closers or doors, as herein specified; and provided, further, that this section shall not apply to elevators in fireproof buildings.

Sec. 671. (**Passenger and Freight Elevators.—Inclosure Of.**)—In all non-fireproof buildings all passenger elevators and all freight elevators, except such as are expressly excepted by this chapter, shall be inclosed in a wall of brick, tile or such other incombustible material as may, from time to time, be approved by the Commissioner of Buildings as proper and suitable for the purpose; such wall to extend from the foundation to the roof of such building, and when built of brick or tile to be entirely self-sustaining; provided, that where such elevator shafts are placed within walls or partitions of fireproof material surrounding such shafts in common with stairways, or in common with stairways and corridors, additional inclosures about such shafts alone shall not be required. Provided, further, however, that the provisions of this section shall not apply to any non-fireproof building which is equipped throughout on every floor and in every room thereof and in all stairways, platforms, elevator shafts, elevator hoistways and well holes with an automatic sprinkler system approved by the Fire Marshal.

Sec. 672. (**Doors.—On Elevators.**)—In all elevator shafts which are herein required to be inclosed with fireproof walls, the openings through which ingress and egress to and from such elevators is had, shall be equipped with fireproof doors, of iron or other incombustible material, to be approved by the Building Commissioner, which shall be made to open from the inside, except that they shall also be made to open from the outside by means of a key or other device satisfactory to the said Commissioner.

Sec. 673. (**Skylights.—Over Elevators.—Windows.**)—The roof of each such passenger elevator, shaft or inclosure shall be formed by a skylight, and passenger elevators shall have a ventilator of at least one-twentieth of the area of the shaft, which shall have an operating device which shall be operative from every floor. Skylights may be omitted in shafts wherein there are windows opening on streets, alleys or courts or other vacant spaces, which will permit sufficient light and air, but such windows shall be glazed with fire-resisting glass.

The foregoing provisions relating to elevators and hoistways shall apply to buildings now existing or hereafter constructed.

Sec. 674. (**Safety of Employes.—Provisions For.**)—Amended by ordinance Nov. 25, 1907, to read as follows:

In every building or structure under construction, where machinery is employed, the belting, shafting, gearing, elevators and every other portion of machinery, when so located as to endanger the lives and limbs of those employed therein while in the discharge of their duties, shall be, as far as possible, so covered or guarded as to make them reasonably safe and to prevent injury to such employes.

ARTICLE XIX.

FIRE ESCAPES AND STANDPIPES.

Sec. 675. (**Buildings Required to Have Fire Escapes and Standpipes.—Inspection.—Fee.**)—Amended by ordinance Nov. 25, 1907, to read as follows:

All buildings in the City of four or more stories in height, except any building used exclusively for a private residence, having two flights of stairs leading from the ground to the top floor of the building, shall be provided and equipped with one or more stairway fire escapes, as described in Section 683 of this Chapter, provided that on any building of Class VI, four stories in height, in which each occupant shall have access to at least two separate and distinct stairways from the top floor to the ground, a combination standpipe

and ladder fire escape may be allowed. And provided also that buildings now in existence having a sufficient number of stairways properly located and which are now equipped with ladder fire escapes shall be exempt from the provisions of this section.

No stairway fire escapes shall be less than twenty-four inches wide and shall have wrought iron or steel balconies with suitable handrailings at each floor, or in such numbers and locations as shall be satisfactory to the Commissioner of Buildings, all firmly secured to the outside walls of the building.

All such fire escapes shall be put up and completed to conform to the buildings for which they are respectively intended, and shall be inspected after completion, and, if found to be in a perfectly safe and satisfactory condition, a certificate to that effect shall be issued by the Commissioner of Buildings to the owner, agent, or occupant of any such building, upon payment to the City Collector of a fee of two (\$2) dollars for each and every fire-escape.

All fire-escapes in the City shall be painted with mineral paint at least once a year.

Sec. 676. (**Specifications for Ladder Fire Escapes.—Anchors.**)—All single and double fire escapes, with ladders, hereafter erected, shall be in strict accordance with the following specifications:

There shall be no less than three one-inch square wrought-iron anchors to every six-foot balcony, and six for a twelve-foot balcony. Such anchors shall pass through the wall of building and bolt on the inside with a three-fourths by two inch nut and three and one-half inch iron washer back of nut, where the wall is not over twenty inches thick; but where wall is over twenty inches thick, anchors shall be inserted at least eight inches into the wall on an angle of thirty-five degrees.

The brace of anchors shall at least be twenty inches spread, and pass into the wall four inches at bottom. No other form of anchors shall be allowed without a special permit from the Commissioner of Buildings.

Sec. 677. (**Balconies.**)—All balconies hereafter erected shall be either steel or wrought iron, capable of sustaining a weight of five hundred pounds to the square foot. The balcony frame shall be made of not less than one and one-half by three inch angle iron, securely riveted together, with crossbars every two feet, such bars to be punched one-half inch square every two inches center, and one-half inch square iron forced through the same, leaving a manhole of not less than twenty-four by twenty-four inches. The crossbars shall be securely riveted to the angle iron frame. The crossbars for a balcony twenty-eight inches wide shall be one and one-half by three-eighths inch iron. Balcony frames over twenty-eight inches wide shall be made of not less than two by three-eighths inch iron to conform with the increased dimensions of iron in crossbars; for thirty-inch balcony, two by three-eighths inch; for thirty-six inch balcony or over, two and one-half by three-eighths inch. All balconies over this width shall have a two-inch "T" iron through the center of balcony for the bars to rest upon. Such balconies shall have a substantial cast or wrought iron post every three feet, bolted to the balcony. No balcony shall have less than two guard rails, which shall be of wrought iron, or new pipe not less than three-fourths inches in diameter, and the ends shall be anchored in the wall of building not less than ten inches on an angle of thirty-five degrees.

Sec. 678. (**Ladders.**)—The ladder, where used in combination with the standpipe, shall be bolted to such standpipe with short tapped bolts every four feet and bolted to the balconies. Rungs of ladder shall be one-half inch square iron, with the corners upward, so as to give a safe footing. Every other run shall be riveted and shall be fourteen-inch centers. Where a ladder is put up without a standpipe, the side guards shall be two by three-eighths inch flat iron or one and one-fourth inch pipe. All ladders shall be seventeen inches or more between pipes. No second-hand pipe shall be used.

Sec. 679. (**Standpipes Outside Buildings.**)—Amended by ordinance of Feb. 17, 1908, to read as follows (Superseding amendatory ordinances of Oct. 22, 1906, and Nov. 25, 1907):

The standpipe shall be of the best three-inch wrought iron, seven and one-half pounds to the foot, and a two and one-half inch brass hose valve, of the City standard thread, shall be attached to the standpipe at every outlet at each floor and on the roof. The owner, agent, occupant, or person in possession, charge or control of the premises where said standpipe is located is hereby required to keep the said standpipe and hose connections oiled, free from all obstructions, in good working order, and accessible for immediate use at all times. The said standpipe and hose valves shall be inspected and tested by the Fire Department as often as once in three months, and oftener if deemed necessary by the Fire Marshal.

Sec. 680. (**Standpipes.—Pumps.—Axes, Etc.**)—Amended by ordinance of July 3, 1907, to read as follows (Superseding amendatory ordinance of March 19, 1906):

(1) *In every building over one hundred (100) feet in height not provided with a three (3) inch or larger standpipe, in all buildings hereafter constructed of a greater height*

than seventy-five (75) feet (except buildings used for theater purposes, as herein elsewhere provided for); in all buildings used for hospital purposes of a greater height than three (3) stories, with accommodations for at least twenty (20) patients; and in all buildings of a greater height than five (5) stories now or hereafter used for hotel or public lodging house purposes there shall be constructed one (1) or more four (4) inch standpipes, which shall extend from basement to roof and which shall be connected at street or alley side of building with two-way Siamese connection for use of Fire Department, and which shall be provided with one hose connection, with Fire Department thread, on the roof of said building, on each floor and in the basement thereof, with sufficient hose attached to reach any point thereof. The pattern, quality, installation and maintenance of such standpipe, hose and couplings, shall be subject to the approval of the Fire Marshal.

(2) In any of the buildings herein referred to where approved sprinkler systems are installed and properly maintained, it shall not be necessary to install additional inside standpipe as above provided for.

(3) On each floor and in the basement of every building used for hotel, public lodging or school purposes, three or more stories in height, there shall be two (2) or more portable hand pumps or chemical extinguishers, one or more fire axes and one or more pike poles. In the basement or janitor quarters of all apartment buildings three or more stories in height, the floors of which are divided into two or more apartments, and in the basement of all office buildings four or more stories in height, there shall be provided one or more portable hand pumps or chemical extinguishers, one or more fire axes and one or more pike poles; all of which shall be installed and maintained subject to the approval and supervision of the Fire Marshal.

(4) The interior of all grain elevators and malt houses of a height of fifty (50) or more feet, which are not entirely fireproof, and which have a capacity of two hundred and fifty thousand (250,000) bushels or over, and the interior of all cold storage houses of a height of four (4) or more stories, which are not entirely fireproof and which have a ground floor area of ten thousand (10,000) or more square feet, shall be equipped with either a dry or wet sprinkler system, to each of which systems there shall be a feeder or riser pipe or pipes not less than four (4) inches in diameter, leading from one or more Siamese steamer connections; all of which shall be installed and maintained subject to the approval of the Fire Marshal.

(5) Grain elevators which are equipped with Journal Fire Alarm Systems of the most approved pattern and which are left at all times in the most perfect working order, or grain elevators, malt houses and cold storage houses, which are now equipped with standpipes of approved pattern and hose with not less than two (2) inch connections which have been installed in accordance with City ordinances and approved by the Fire Department, each floor of which is approved by said department as being at all times easily accessible to firemen, where fire extinguishers, water barrels and pails are distributed at intervals on all floors on advice and instruction of the Chicago Underwriters' Association; where the necessary pump pressure is maintained; where some approved electric watch service and fire alarm system is maintained and watchmen are employed during nights, Sundays and holidays, pulling such stations not less frequently than once per hour, and which have outside Siamese connections and standpipes not less than two and one-half (2½) inches, shall be exempt from the provisions of this ordinance.

Sec. 681. (**Siamese.**)—Amended by ordinance Feb. 17, 1908, to read as follows:

There shall be a two-way automatic Siamese at the bottom of each standpipe, so that two steam fire engines may be attached to it without interfering with each other. Such Siamese shall be within easy reaching distance from the sidewalk and be securely anchored to the wall of the building. The owner, agent, occupant, or person in possession, charge or control of the premises where such standpipe and Siamese are located, is hereby required to provide such covering or protection to the fittings of said Siamese steam engine connection for the purpose of keeping said fittings and connection clear and unobstructed as shall be ordered and required by the Fire Marshal. The protection or covering herein referred to shall apply to all standpipes located inside of buildings, as well as outside of buildings, and include connections to automatic sprinkler equipment.

Sec. 682. (**Anchors for Top of Standpipe.—Painting.**)—All the anchors for the top of standpipe and ladders shall pass through the wall and bolt on the inside of same.

All work shall be painted with two coats of the best mineral paint, and all holes shall be filled up with the best cement.

Sec. 683. (**Stairway Fire Escapes.—Erection of.—Location.—Component Parts.**)—The Commissioner of Buildings or Inspectors shall determine upon the location of all stair fire escapes before erection of same is commenced.

A permit shall be obtained from the Department of Buildings before work is commenced, which permit will be issued on payment to the city collector of a fee of two (\$2) dollars.

No permit for a stairway fire escape projecting three feet or more from the face of the wall shall be granted unless a detailed plan for the fire escape, approved by

a licensed architect or practicing structural engineer, is submitted to the Commissioner of Buildings, and a copy of such plans shall be left on file with said commissioner.

(Anchors.)—All anchors for stairway fire escapes shall, wherever possible, pass through the wall of building and be secured on inside of same. Where it is impossible to anchor through walls, anchors shall be put in wall not less than fifteen inches at an angle of thirty-five degrees. On buildings of steel construction, where walls are less than twenty inches in thickness, there shall be steel channels at least four inches wide set on inside of building from column to column and bolted or riveted to columns, and anchors shall be bolted on inside of channels.

Anchors for a platform four feet two inches or less in width shall be made of one-inch square iron; over four feet two inches and not over six feet, shall be one and one-fourth inch square iron, with brace; over six feet, shall be one and one-half inch square iron, with brace. All anchors shall be turned up not less than six inches at the outside of platform to bolt post to.

(Braces.)—Braces shall be the same thickness as the anchors. Spread of braces shall be the width of platform. Where the platforms are over five feet in width, anchors shall have double braces, one to the outside and one to the center of platform.

(Platforms.)—Platforms shall be not less than fifty inches wide at ends; passageways shall be not less than twenty-four inches between building and railings. Platforms shall be not less than twelve feet in length. The frames and crossbars shall be made as specified by Section 677 of this chapter. Platforms shall have clips at each end bolted to anchors. No door or window or shutter shall open so as to obstruct in any way the free passage on or along a platform or a staircase or ladder fire escape.

(Stairs.)—All fire escape stairs for apartment buildings, hotels, boarding houses, factories and office buildings, where there are less than one hundred people, shall be not less than two feet wide between railings and stringers. Where there are more than one hundred people, stairs shall be three feet wide. All stairs for halls, churches, theaters, hospitals, schools, department stores and buildings where large numbers of people congregate shall be not less than three feet wide in the clear, and all passageways shall be not less than three feet wide in the clear; stringers shall be made of two bars three by five-sixteenths inch, about one inch apart, or four and one-half by three-eighths inch flat iron. Where over twelve feet in length, they shall have anchor and brace in center. The treads shall be made of one-half inch square steel or iron, corner upwards not to exceed one and five-eighths inches center, riveted at ends to two by five-sixteenths inch flat iron or steel. There shall be not less than four bars to a tread, where treads are less than twenty-seven inches in length; where treads are over twenty-seven inches in length, there shall be not less than six bars to a tread; then, there shall be a truss supporting treads made of bar iron two inches by three-eighths of an inch, riveted to bars of treads in center, supported by two seven-sixteenths inch rods bolted at each end of treads. All stairs shall have an incline of about forty-five degrees; rise of treads shall be not less than seven inches and not more than ten inches.

(Railings.)—All stairs shall have three bar railings made of one-inch bar iron for top rail and three-quarter inch bar iron for lower rail, and when such stairs are more than three inches from wall of building, then there shall be one or more hand rails on the wall side of such stairs.

(Posts.)—All posts used for stair fire escapes shall be made of one and one-half inch angle or channel iron not less than three feet six inches high, and shall have braces on outside turned upwards and fastened to frame of balcony or stairs and not less than half way up the post; all stair fire escapes shall extend to the ground, either by counterbalance or drop stairs. Cables for counterbalance stairs shall be not less than three-quarters inch in size, and shall be well oiled or greased when hung up, and oiled or greased at least once a year. All pulleys and cables holding counterbalance shall be covered at bracket, so as to protect it from snow or ice.

(Painting.)—All stair fire escapes shall be painted with two coats of paint, one at the shop and one after completion at the building.

Where it is impossible to erect stair fire escapes according to these specifications, then plans shall be submitted to the Commissioner of Buildings or *Inspectors* for approval.

All such fire escapes shall, on completion, be inspected by the *Inspectors*, and if found safe and satisfactory, a certificate will be issued upon payment of one (\$1) dollar to the city collector.

As amended Nov. 25, 1907 (Substituting the word "Inspectors" for the words "Fire Escape Inspectors," wherever they occur.)

Sec. 684. **(Fire Escapes in General.)**—No fire escape of any kind shall be constructed except upon a permit therefor issued by the Commissioner of Buildings upon the payment by the applicant therefor to the city collector of a permit fee of two dollars.

Every building in the city required by law to be equipped with metallic stand-pipes and wrought iron or steel balconies, or other fire escape devices, shall have displayed in conspicuous places, on each floor of such building, notices sufficient in number and in plainly legible type at least six inches in height, indicating and showing the location of such metallic ladders, balconies and fire escapes and the easiest way to reach them. If such notices be not displayed within thirty days after such equipment and kept continuously displayed, said commissioner is authorized to take such action as may be necessary to have such building closed.

Sec. 685. (Penalty.)—Any owner, agent or person in possession, charge or control of any such building, who violates, disobeys, omits or neglects to comply with the terms of the foregoing section, shall be fined not less than five dollars nor more than fifty dollars for each offense, and every such owner, agent or person shall be deemed guilty of a separate offense for every day such violation, disobedience, omission or neglect shall continue, and shall be subject to the penalty imposed hereby for each and every such separate offense.

Where stair fire escapes pass windows or doors, the windows or doors shall be of fire-resisting glass and have metal frames and sash, or such fire escapes shall be hooded with metal for at least two feet each side of such opening.

ARTICLE XX.

FIRE LIMITS.

As defined by ordinance passed March 29, 1909.

Sec. 686. (Fire Limits of City.)—The fire limits of the City of Chicago shall be and are hereby defined as follows: All that part of the City of Chicago bounded by the following limits: Commencing at the intersection of the shore of Lake Michigan and a line one hundred and fifty feet north of the center line of Belmont avenue, thence west on said first mentioned line to the center line of North Halsted street, thence south along said center line of North Halsted street to the center line of Fullerton avenue, thence west along said center line of Fullerton avenue to the center of the North Branch of the Chicago River, thence northwesterly along the center of said North Branch of the Chicago River to the center line of Belmont avenue, thence west along said center line of Belmont avenue to the center line of Kedzie avenue, thence south along said center line of Kedzie avenue to the center line of West North avenue, thence west along said center line of West North avenue to the center line of North Fortieth avenue, thence south along said center line of North Fortieth avenue to the center line of the first alley north of Park avenue, thence west along the center line of said alley to the center line of South Forty-sixth avenue, thence south along said center line of South Forty-sixth avenue to the center line of West Madison street, thence west along the center line of West Madison street to the center line of South Forty-eighth avenue, thence north along said center line of South Forty-eighth avenue to the center line of Kinzie street, thence west along said center line of Kinzie street to the center line of South Fifty-second avenue, thence south along said center line of South Fifty-second avenue to the center line of West Madison street, thence east along said center line of West Madison street to the center line of South Fiftieth avenue, thence south along said center line of South Fiftieth avenue to the north line of the present right of way of the Chicago & Great Western Railroad Company, thence east along the said north line of said right of way to the center line of South Forty-eighth avenue, thence south along the said center line of South Forty-eighth avenue to the center line of West Twelfth street, thence east along said center line of West Twelfth street to the center line of South Forty-sixth avenue, thence south along said center line of South Forty-sixth avenue to the center line of West Twenty-second street, thence east along said center line of West Twenty-second street to the center line of South Fortieth avenue; thence south along said center line of South Fortieth avenue to the center line of the Illinois and Michigan Canal, thence northeasterly along the center line of the said canal to the center line of South Western avenue; thence south along said center line of South Western avenue to the center line of West Thirty-ninth street, thence east along said center line of West Thirty-ninth street to the center line of State street, thence south along said center line of State street to the north line of West Forty-seventh street, thence west along said north line of West Forty-seventh street to a line seventy-five feet west of the west line of South Halsted street, thence south to a line seventy-five feet north of the west line of South Halsted street along said line seventy-five feet west of the north line of West Sixty-third street, thence west along said line seventy-five feet north of the north line of West Sixty-third street to the center line of South Ashland avenue, thence south along the center line of South Ashland avenue to the center line of West Sixty-third street, thence east along said center line of West Sixty-third street

to the center line of State street, thence south along said center line of State street to the center line of East Seventy-fifth street, thence east along said center line of East Seventy-fifth street to the center line of Colfax avenue, thence south along the center line of Colfax avenue to the center line of Seventy-ninth street, thence east along the center line of Seventy-ninth street to the shore of Lake Michigan, thence northerly and northwesterly along the shore of Lake Michigan to the place of beginning.

Also, commencing at a point in the center of Manistee avenue, where it intersects the right of way of the main line of the Lake Shore & Michigan Southern Railroad; thence northeasterly and north along the center line of Manistee avenue to the center line of Eighty-ninth street, thence east along the center line of Eighty-ninth street to the center line of Mackinaw avenue, thence south along the center line of Mackinaw avenue to the center line of Harbor avenue, thence southwesterly along the center line of Harbor avenue to the center line of Ninety-third street; thence west along the center line of Ninety-third street to the easterly line of the Baltimore & Ohio railroad right of way; thence south along the easterly line of the Baltimore & Ohio railroad right of way and Baltimore & Ohio railroad extended, to the northeasterly line of said Lake Shore & Michigan Southern Railroad; thence northwesterly along the northeasterly line of said right of way to the place of beginning.

As defined by ordinance Passed March 29, 1909.

Also commencing at the east line of Jackson Park avenue and the south line of the Pittsburgh, Ft. Wayne and Chicago Railroad Company's right-of-way, and running southeasterly along the right-of-way along the Pittsburgh, Ft. Wayne and Chicago Railroad Company's right-of-way to the north line of Eighty-third street, thence west along the north line of Eighty-third street to Jackson Park avenue, thence north along the east line of Jackson Park avenue to the place of beginning.

Sec. 687. (**Fire Limits.—Provisional.**)—Provided, however, that any person desiring to erect a frame or wooden building, to be used for residence or mercantile purposes within that portion of the territory bounded on the east, between Sixty-seventh and Seventy-fifth streets, by Lake Michigan, on the south by the center line of Seventy-fifth street, on the west by the center line of State street to the intersection of Sixty-third street, thence east along the center line of Sixty-third street to the intersection of Cottage Grove avenue, thence south along the center line of Cottage Grove avenue to the intersection of Sixty-seventh street, thence east along the center line of Sixty-seventh street to Lake Michigan, shall have a right to do so, upon presenting a petition to the Commissioner of Buildings, together with a plat, plans and specifications showing the place where such building is to be erected. Such petition shall be verified by the affidavit of the applicant and shall contain the written consent of the owners of a majority of the frontage upon each side of the streets or alleys in the block or square in which the building is to be erected.

No frame or wooden residence or mercantile building shall be erected within the said provisional fire limits exceeding forty feet in height unless the basement story shall be constructed of brick or stone, in which case the height shall not exceed forty-five feet above the sidewalk.

Sec. 688. (**Fire Limits.—Exception From.**)—There shall be excepted from the fire limits as hereinbefore defined, the territory bounded as follows:

Commencing at the intersection of a line seventy-five feet west of the west line of State street and a line seventy-five feet south of the south line of Forty-seventh street, thence west along said line seventy-five feet south of the south line of Forty-seventh street to a line seventy-five feet east of the east line of Wentworth avenue, thence south along said line seventy-five feet east of the east line of Wentworth avenue to a line seventy-five feet north of the north line of Sixty-third street to a line seventy-five feet west of the west line of State street, thence north along said line seventy-five feet west of the west line of State street to the place of beginning.

Also that territory within the lines beginning at the intersection of a line seventy-five feet west of the west line of Wentworth avenue, and a line seventy-five feet south of the south line of Forty-seventh street; thence west along said line seventy-five feet south of the south line of Forty-seventh street to a line seventy-five feet east of the east line of South Halsted street; thence south along said line seventy-five feet north of the north line of Sixty-third street; thence east along said line seventy-five feet north of the north line of Sixty-third street to a line seventy-five feet west of the west line of Wentworth avenue; thence north along said line seventy-five feet west of the west line of Wentworth avenue to the place of beginning.

As amended by ordinance of February 26, 1906.

ARTICLE XXI. FRONTAGE CONSENTS.

Sec. 689. (**Definition of Word "Block," as Used in This Chapter.**)—Whenever in this chapter a provision is made that frontage consents shall be obtained for the erection, construction, alteration, enlargement or maintenance of any building or struc-

ture in any block, the word "block," so used, shall not be held to mean a square, but shall be held to embrace only that part of a street bounding the square which lies between the two nearest intersecting streets, one on either side of the point at which such building or structure is to be erected, constructed, altered, enlarged or maintained, unless it shall be otherwise specifically provided.

Sec. 690. (**Hospitals.—Permits.—Special Consents.—Height Of.**)—It shall be unlawful for any person or corporation to build, construct, maintain, conduct or manage in any block, if two-thirds of the buildings fronting upon both sides of the streets bounding such block or square are devoted exclusively to residence purposes, any hospital for the care, treatment or nursing of three or more insane persons; or any hospital for the care, treatment or nursing of three or more inebriates, or persons suffering from the effects of the excessive use of alcoholic liquors; or any hospital for the care, treatment or nursing of three or more epileptics; or any hospital for the care, treatment or nursing of three or more persons addicted to, or suffering from, the excessive use of morphine, cocaine or other similar drugs or narcotics; or any hospital for the care, treatment or nursing of any person or persons affected with any infectious or contagious disease, unless the owners of a majority of the frontage in such block and in addition thereto the owners of a majority of the frontage on the opposite sides of the streets bounding such block consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in such block. Such written consents of the majorities of such property owners shall be filed with the Commissioner of Buildings, and an exact copy of same shall be filed with the Commissioner of Health before a permit shall be granted for the building or constructing or a license issued for the maintaining, conducting or managing of any such hospital. Provided, that any such building that may be used for such purposes as set forth in this section and which is over two stories in height shall be of fireproof construction throughout, and no hospital shall be built to exceed six stories in height. (Repealed—See note at bottom of page.)

Sec. 691. (**Hospitals.—Location of Near School Houses.**)—Amended by ordinance March 4, 1907, to read as follows:

No hospital of any kind or description hereafter erected or established shall be erected or established on any lot or parcel of ground any part of which is located within four hundred feet by the nearest traveled route of any property used for school purposes. (Repealed—See note at bottom of page.)

Sec. 692. Amended July 13, 1908, to read as follows:

It shall not be lawful for any person or corporation to locate, build, construct or maintain on any street or alley in the city any building or place used for junk shop or junk yard without the written consent of a majority of the property owners in the block in which said junk shop or junk yard is sought to be located, built, constructed or maintained according to the frontage on both sides of such street or alley; nor for any person or corporation to locate, build, construct or maintain on any street or alley in the city in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes any building or place used for gas reservoir, packing house, rendering plant, soap factory, tannery, boarding, livery or sale stable, blacksmith shop, foundry, brewery or distillery, grain elevator, or laundry to be run by machinery, or machine shop, without the written consent of a majority of the property owners according to the frontage on both sides of such street or alley.

Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction of any such building or place: provided, that in determining whether two-thirds of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street and located upon a corner lot shall not be considered.

Note.—See also ordinance amending this section as to Blacksmith Shops, under "Amendments," on page 177.

Under amendments see also ordinance requiring frontage consents for buildings used for theatrical or dramatic entertainments, etc., together with an ordinance prohibiting such buildings nearer than 200 feet of a church or educational building.

Sec. 693. (**Reformatories.—Sheltering Institutions.**)—It shall be unlawful for any person or corporation to build, construct, maintain, conduct or manage any reformatory, rescue or sheltering institution in any block or square in which two-thirds of the buildings on both sides of the street or streets on which the proposed reformatory, rescue or sheltering institution may front are used exclusively for residence purposes, without the written consent of a majority of the property owners, according to frontage, on both sides of the streets bounding such block.

Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or keeping of such building.

Note:—These two sections, 690 and 691 (together with 279), repealed by ordinance governing Hospitals, passed June 1, 1908, page 509 et seq., Council Proceedings.

Provided, that in determining whether two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered.

Sec. 694. (Permits for Moving Frame Buildings.—Requirements.—Written Consents Must Be Obtained.—Affidavits Made.)—Permits to move frame buildings shall be granted, if any such frame building has not been damaged to an extent greater than fifty per cent of its original cost, by fire, wear and tear, the action of the elements or otherwise. Any person desiring to remove a frame building shall first obtain the written consent to such removal from persons owning a majority of the frontage of the lots on both sides of the street in the same block to which the building is to be removed.

As amended by ordinance of June 5, 1906.

This section shall not apply to the case of any person removing a building upon his own premises and not going upon the premises of any other person, or upon any street, alley or other public place, in making such removal.

Provided, however, that no permit shall be issued for the removal of any frame building from any point outside the fire limits to any point within the fire limits, when such building is of such a character that it would not be lawful to build it within the fire limits.

ARTICLE XXII.

USE AND OBSTRUCTION OF STREETS FOR BUILDING PURPOSES.

Sec. 695. (Sidewalk and Street.—Occupation Of.—Limitations.)—The extent of occupation of sidewalk and street to be covered by the terms of a permit for street obstruction or building shall be as follows:

Such permit shall not authorize the occupation of any sidewalk or street or part thereof other than that immediately in front of the lot or lots upon which any building is in process of erection and in relation to which such permit is issued.

During the progress of building operations a sidewalk not less than four (4) feet in width shall be at all times kept open and unobstructed for the purpose of passage in front of such lot or lots. Such sidewalk shall, if there are excavations on either side of the same, be protected by substantial railings which shall be built and maintained thereon so long as such excavations continue to exist. It is not intended hereby to prohibit the maintenance of a driveway for the delivery of material across such sidewalk from the curb line to the building site.

Sec. 696. (Sidewalks.—Delivery of Material.—Elevated Sidewalks.)—It shall be permitted for the purposes of delivering material to the basements of buildings in process of erection to erect elevated temporary sidewalks to a height of not exceeding four feet above the curb level of the street; and in case a sidewalk is so elevated, it shall be provided with good, substantial steps or easy inclines on both ends of the same and shall have railings on both sides thereof.

Sec. 697. (Sidewalks.—Temporary Roof Over.—Time Maintained.)—If the building to be erected is more than four stories in height, and is set at or near the street line, there shall be built over the adjoining sidewalk a roof having a framework and covering composed of supports and stringers of three by twelve timbers, not more than four feet from centers, covered by two layers of two-inch plank.

Such roof shall be maintained as long as material is being used or handled on such street front and above the level of such sidewalk.

In all cases such temporary sidewalks and their railings and approaches, and the roofs over the same, shall be made, as regards ease of approach, strength and safety, to the satisfaction of the Commissioner of Buildings.

Sec. 698. (Street.—Storage of Building Materials.—Limitations.)—The occupation of the street for the storage of building materials, or for temporary sidewalks, shall never exceed, in front of any one building, one-third of the width of the roadway of the same, and in no event shall any material be stored or placed within four feet of any street or steam railway track.

Sec. 699. (Sidewalks and Street.—Excavated Material and Rubbish On.—How Cared For.)—Earth, other than sand to be used in the construction of the building, taken from excavations, and rubbish taken from buildings shall not be stored either upon sidewalks or roadways of streets, and shall be removed therefrom from day to day as rapidly as produced. When dry rubbish, apt to produce dust, is being handled, it shall be kept wetted down so as to prevent its being blown about by the wind.

Sec. 700. (Derricks.—Limitations.)—For all buildings more than four stories in height, the use of derricks set upon the sidewalk or street is prohibited. In no case shall the guy lines be less than fifteen feet above the roadbed.

Sec. 701. (Frontage Adjacent.—How Occupied for Building Purposes.)—If the written consent and a waiver of claims for damages against the city of the owners of

as hereinafter fixed; but such alteration shall not be construed to apply to the changing of any advertising matter of any billboard or signboard, nor the refacing of the framework supporting same.

Sec. 711. (Billboards Now Existing to be Altered to Comply with the Provisions of this Article.)—Every now existing billboard or signboard, whether erected upon or above the roof of any building or attached or fastened to the wall or walls of any building, or standing upon or erected upon any lot or premises, which is now erected or which is now maintained contrary to the provisions of this article, shall be forthwith removed or altered, changed, or cut down so as to fully comply with such provisions; and any billboard or signboard now existing and not complying with the provisions of this article which shall not have been removed or torn down or so altered and changed within nine months from and after the passage of this ordinance as to be brought into conformity with the provisions of this article by the owner thereof or by the person in charge, possession, or control thereof, shall be torn down by the Commissioner of Buildings and the cost and expense of tearing down such billboard or signboard shall be charged to the owner of such billboard or signboard or the person in charge, possession, or control thereof, and shall be recovered from such person for the use of the city by any appropriate proceeding therefor.

Sec. 712. (Duty of Commissioner.—Owner's Name to be Placed on Top of Billboard.)—It shall be the duty of the Commissioner of Buildings to inspect all plans and specifications submitted in connection with the erection or construction or the alteration or repair of any billboard or signboard and to approve same if the method of construction and provisions made for fastening, securing, anchoring and maintaining such billboards or signboards are such as will serve to protect the public and to render such billboards or signboards safe and substantial. It is further made the duty of the Commissioner of Buildings to exercise a supervision over all billboards and signboards erected or being maintained under the provisions of this article; and whenever it shall appear to said Commissioner that any such billboard or signboard has been erected in violation of this ordinance or is in an unsafe condition or has become unstable or insecure or in such a condition as to be a menace to the safety of the public, he shall thereupon issue or cause to be issued a notice in writing to the owner of such billboard or signboard or the person in charge, possession or control thereof, if the whereabouts of such person is known, informing such person of the violation of this ordinance and the condition of such billboard or signboard and directing him to make such alterations or repairs thereto or to do such acts or things as are necessary or advisable to place such billboard or signboard in a safe, substantial and secure condition, within such reasonable time as may be stated in said notice. If the person so notified shall refuse, fail, or neglect to comply with and conform to the requirements of such notice, said Commissioner shall, upon the expiration of the time herein mentioned, tear down or cause to be torn down such billboard or signboard, and shall charge the expense of such tearing down to the person so notified. If the owner of such billboard or signboard or the person in charge, possession, or control thereof cannot be found or his whereabouts is not easily ascertainable, the Commissioner shall attach or cause to be attached to such billboard or signboard a notice of the same import as that required to be sent to the owner where such owner is known; and if such billboard or signboard shall not have been made to conform to this ordinance and placed in a secure, safe, and substantial condition, in accordance with the requirements of such notice, within thirty days after such notice shall have been attached to such billboard or signboard, it shall be the duty of the Commissioner of Buildings to thereupon order such billboard or signboard torn down; provided that nothing herein contained shall prevent the Commissioner of Buildings from adopting such precautionary measures as may be necessary or advisable in case of imminent danger in order to place such billboard or signboard in a safe condition, the expense of which may be charged to and recovered from the owner of same in any appropriate proceeding therefor. No permit shall be issued to any applicant for permission to erect a billboard or signboard unless such applicant shall agree to place and maintain on the top of such billboard or signboard the name of the person or corporation owning same or who is in charge, possession, or control thereof. It shall be the duty of the Commissioner of Buildings to see to it that the name of the person or corporation owning or in possession, charge, or control of such billboard or signboard is placed upon such billboard or signboard forthwith upon the erection thereof and is kept thereon at all times while such billboard or signboard is maintained; and in case the owner of such billboard or signboard or the person in charge, possession, or control thereof shall fail or refuse to place and maintain such name on the same after due notice from the Commissioner of Buildings he shall be subject to the penalty hereinafter provided for.

Sec. 713. (Fees for Permits.—Indemnifying Bond.)—Amended by ordinance Dec. 2, 1907, to read as follows:

The fee to be charged for permits issued for the erection or construction of billboards or signboards or for the alteration thereof shall be two dollars for each twenty-five lineal feet of billboard or signboard so erected.

Any person, firm or corporation engaged in the business of erecting billboards or signboards within the City limits for the purpose of display advertising shall file with the City Clerk of the City of Chicago an approved bond in the sum of twenty-five thousand (\$25,000) dollars to indemnify the City against any lawsuits brought or judgments obtained against the City of Chicago, or any of its officials, resulting from accidents by such billboards or signboards.

Sec. 714. (Penalty.)—Any person or corporation owning, operating, maintaining, or in charge, possession, or control of any billboard or signboard within the city, who shall neglect or refuse to comply with the provisions of this article, or who erects, constructs or maintains any billboard or signboard that does not comply with the provisions of this article, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense; and each day on which any such person shall permit or allow any billboard or signboard owned, operated, maintained or controlled by him, to be erected, constructed, or maintained in violation of any of the provisions of this article, shall constitute a separate and distinct offense.

Sec. 715. (Fences.—Height of.)—No wooden fences shall be constructed of greater height than eight feet above the sidewalk grade or eight feet above the surface of the ground where no grade is established.

ARTICLE XXIV. STORAGE OF OILS.

Sec. 716. (Storage of Oils.—Buildings for Storage of Oils.—Walls.—Roof.—Floor.)—Buildings designed for the storage of crude petroleum, gasoline, naphtha, benzine, camphine, carbon oil, spirit gas, burning fluid, spirits of turpentine or coal, rock or earth oils (excepting such refined oils as will stand a fire test of one hundred and fifty degrees Fahrenheit according to the method and direction of John Tagliabue), shall be constructed as follows:

The walls shall be of brick, stone, or concrete, and shall be not less than sixteen inches thick or more than sixteen feet high. The lower floor of such buildings shall be at least three feet below the grade of the adjoining street and shall be made of earth, concrete or brick. The roof of such buildings shall be made of tile, metal or other incombustible material, and the outside walls of any such building having a flat roof shall extend at least eighteen inches above the roof. The coping upon the roof of such buildings shall be made of incombustible material. Such buildings shall be detached from all other buildings and shall be properly ventilated. Where any such building shall be located less than twenty-five feet away from any other building or structure, the wall or walls of such building on the side or sides thereof, within such distance of twenty-five feet from any other building or structure shall have no window or other opening therein; provided, however, that if such building cannot be so constructed that no outside wall thereof shall be less than twenty-five feet away from any other building or structure, in such case, openings may be made in the wall of such building which is located farthest away from any other building or structure for the purpose of admitting light or providing means of access thereto or egress therefrom. If such opening be a window, the glass in such window shall be fire-resisting glass, and such window shall be provided with a steel shutter.

No such building shall be occupied for any purpose other than the storage of oils, and no person shall be permitted to use any such building as a sleeping apartment or dwelling place.

The interior cubic capacity of any such building shall exceed by at least twenty-five per cent the total capacity of the tanks or other receptacles placed in such building.

Such buildings and the equipment thereof, including the protection of the doors and windows, shall be constructed according to plans and specifications which have been submitted to and approved by the Commissioner of Buildings.

Sec. 717. (Tanks for Storage of Oils.)—Tanks for the storage of any one or more of the oils or fluids mentioned in the preceding section may be built outside of buildings either above or under the surface of the ground, provided the following specifications are complied with:

Such tanks shall be made of metal of sufficient gauge and tensile strength for the purpose for which they are to be used. All portions of such tanks are to be riveted together and shall be made liquid tight. Every such tank shall have a manhole and shall be equipped with adequate ventilating or safety devices.

All tanks other than those located in buildings constructed under the provisions of Section 716 of this article, whether placed above or below the surface of the ground, shall have no building or structure of any kind whatsoever over or above the same; provided, however, that if any such tank be located near a railroad track or manufactory or place where sparks are likely to fall, and it is desired, in order to obviate such danger, to construct over such tank a shed or shelter, such shed or shelter may be constructed upon a permit in writing therefor being issued by the Commissioner of Buildings; and such permit shall only be issued if it shall be shown that such shed or shelter is necessary and upon the express agreement that such shed or shelter shall be used for no other purpose than affording protection or shelter, and shall not be used for storage, manufacturing, residence, office, or any other purpose whatsoever.

Sec. 718. (**Walls Around Tanks.**)—Where any such storage tank or any portion thereof is erected or maintained upon or above the surface of the ground and is situated less than fifty feet from any other building or structure other than the buildings or structures upon the premises wherein such oils or fluids are to be used or stored, such tanks shall be separated from any such building or structure by an inclosing wall of brick, stone or concrete; and such wall shall be not less than five feet high and in no case of less height than two feet higher than the top of the tank which it is designed to separate from such building or structure. If such wall be ten feet high or less it shall be not less than twelve inches in thickness, and four inches in thickness shall be added for every additional ten feet or major fraction thereof of height added to such wall. Such wall shall entirely surround or inclose such tank; provided, however, that an opening may be constructed in such inclosing wall to permit access to the tank. Such opening shall contain a liquid-tight door made of incombustible material, either sliding or opening inward, and of sufficient strength to resist any pressure which may be brought to bear on such door by the bursting of the tank inclosed in such wall.

All such tanks and walls described in this section shall be constructed in accordance with plans and specifications which shall have been submitted to and approved by the Commissioner of Buildings.

Sec. 719. (**Storage of Petroleum, Etc.**)—It shall be unlawful for any person or corporation to keep or store crude petroleum, gasoline, naphtha, benzine, camphine, carbon oil, spirit gas, burning fluid, spirits of turpentine, or coal, rock or earth oil (excepting such refined oils as will stand a fire test of one hundred and fifty degrees Fahrenheit, according to the method and direction of John Tagliabue), upon or in any structure or premises, in any quantity exceeding one barrel of fifty gallons, within the city, except in such a building or such tanks as are hereinbefore described in this article, and where a quantity of any of such oils exceeding five gallons and not exceeding fifty gallons is kept in any premises other than such a building the receptacle or receptacles in which such oils is or are kept shall not be placed under any stairway or in any confined space, but shall be kept in such manner that no vapor or gas therefrom can collect in such a quantity as to become dangerous; and no such receptacle or receptacles shall be stored, kept or handled at any time within fifteen feet of any gas, candle, oil or other like artificial light or near any lighted stove, gas grate or any open flame of any kind whatsoever; provided, however, that a quantity of such oils exceeding one barrel of fifty gallons and not exceeding five barrels of fifty gallons each may be kept or stored in a room or apartment, the floor of which shall be at least five feet below the grade of the street adjacent to the building or structure in which such room or apartment is located, and such room or apartment shall have an air capacity of not less than fifteen hundred cubic feet and shall be properly ventilated in such manner as to prevent a dangerous accumulation of vapor or gas from such oils; and such room or apartment shall not be used for any purpose other than the storage and handling of such oils. In any such room or apartment as is last above described turpentine may be kept in a quantity not exceeding five hundred gallons.

No gas, candle, oil, or other like artificial light or lighted stove, gas grate, or other open flame of any kind whatsoever shall be allowed within fifteen feet of any receptacle or receptacles containing any of the oils or fluids mentioned in this article, while located, kept, or stored in any such room or apartment. If more than fifteen (15) barrels of any of the oils hereinbefore described are kept in any such building as herein provided for, such building shall be located not less than 100 feet away from any other building or structure.

Sec. 720. (**Petroleum, Etc., in Transit Not to Be Kept Near Buildings.**)—It shall be unlawful for any person or corporation engaged in the business of transporting or delivering any of the oils or fluids mentioned in this article to permit such oils or fluids to remain in barrels, tanks, or other like receptacles, upon any railroad track, street, wharf, or dock for a longer time than is reasonably necessary to make

provision for the storing or delivering of same; such time in no event, however, to exceed twenty-four hours.

Sec. 721. (Oils, Sale of, Regulated.)—It shall be unlawful for any person or corporation to sell, deliver, or receive any of the oils or fluids mentioned in this article, by gas, candle, oil, or other like artificial light.

ARTICLE XXV.

MISCELLANEOUS PROVISIONS.

Sec. 722. (Roofs for Spectatorial Purposes.—Permits.)—It shall be unlawful for any person, whether owner, lessee, manager or person in control or having charge of any building within the city, to permit the use of the roof of any house or building, whether free of charge or through admission fee, to any person as a place of observation or for spectatorial purposes, unless he has first obtained from the Commissioner of Buildings of the city a permit; provided, however, it shall not be unlawful for any person, whether, owner, lessee, or the person in control or having charge of such house or building, to permit the roof of any such house or building to be used as a place of observation or for spectatorial purposes for a number of persons not exceeding ten, and when no admission fee is charged.

Sec. 723. (Inspection as to Safety of Buildings.)—Before issuing the permit, as provided for in the foregoing section, the Commissioner of Buildings shall make an investigation as to whether such building is safe and secure enough to permit the presence of an estimated number of persons upon the roof thereof, and the permit so issued shall state the number of persons to be permitted on such roof. The Commissioner of Buildings shall see to it that every such roof is surrounded and enclosed with a railing or balustrade of sufficient height and strength to afford adequate protection.

Sec. 724. (Fee for Inspection.)—The person requiring such permit, as hereinabove provided for, shall make application to the Commissioner of Buildings for such an investigation, and shall pay, as a fee for such investigation and such permit, the sum of five dollars.

Sec. 725. (Penalty.)—Any person, whether owner, lessee, manager or person having charge or control of any such house or building within the city who shall permit, allow or tolerate the use of the roof of such house or building so controlled by him, by any person for a purpose within the meaning of Section 722 of this article, without first obtaining a permit as hereinbefore provided for, and without having the safety of such roof tested and investigated by the Commissioner of Buildings, as hereinbefore provided for, or who shall permit a larger number of persons than is provided for in his permit to congregate upon such roof, shall be fined not less than twenty-five dollars nor more than one hundred dollars for each offense.

Sec. 726. (Windows, Cleaning of.—Safety Devices.)—The owner or agent of every building hereafter erected in the city shall equip each and every window in any such building, above the second story thereof, with a suitable device or devices which will permit the cleaning of the exterior of each and every window in such building, above the second story, without danger to the person cleaning such windows, such devices shall be of such pattern and construction as will reasonably answer the purposes for which they are intended. Provided, however, that if windows are of such size that they may be easily cleaned from the inside, they need not be equipped with such devices.

Sec. 727. (Penalty.)—Any owner or agent of any building described in the preceding section who shall fail, neglect or refuse to comply with any of the provisions of such section, shall be fined not less than ten dollars nor more than fifty dollars for each offense, and each and every day which shall be allowed to elapse before any such building shall be supplied and equipped in accordance with the provisions of said section, shall constitute on the part of the owner or agent of any such building a separate and distinct offense.

Sec. 728. (Scaffolds.—Protection During Building Operations.—Temporary Floors.)—All scaffolds erected in this city for use in the erection, repair, alteration or removal of buildings, shall be well and safely supported, and of sufficient width, and properly secured, so as to insure the safety of persons working thereon or passing under, or by the same, and to prevent the falling thereof, or of any material that may be used, placed or deposited thereon.

It shall be the duty of every owner, person or corporation who shall have the supervision or control of the construction or remodeling of any building having more than three (3) framed floors, whether some or all of such floors are above or below the established street grade, to provide and lay upon the upper side of the joists or girders, or both, of the first floor below the riveters and structural steel setters, a

plank floor, which shall be laid to form a good and substantial temporary floor for the protection of employes and all persons engaged above or below or on such temporary floor in such building.

Provided, however, that where the permanent floor is in place on the floor herein required to be planked, a temporary protective floor shall not be required.

If the floor or permanent floor of the second floor, or of any other floor above the second, or roof, is being placed previous to the permanent floor of the floor immediately below the floor which is being arched or planked, a good and substantial temporary floor shall be laid on the joists and girders of the next lower floor. For the purposes of this section the lowest framed floor in a building shall be considered the first floor.

In buildings more than three (3) stories high, where persons are working on a scaffold or scaffolds on the outside of such building, such persons shall be protected by well-secured planking, set over the heads of such persons for the full width of the scaffolding on which they are working, if another story or other stories are being raised above such persons during the time they are working on such outside scaffold or scaffolding.

It shall be the duty of all owners, contractors, builders or persons having the control or supervision of all buildings in course of erection which shall be more than thirty (30) feet high, to see that all stairways, elevator openings, flues and all other openings in the floors shall be covered or properly protected.

Sec. 729. (**Penalty.**)—Any person violating any of the provisions of the foregoing section shall be fined not less than one hundred dollars nor more than two hundred dollars for each offense, and any permit granted for the construction of such building by the authorities of the city may be revoked in the discretion of the Commissioner of Buildings.

Sec. 730. (**Gas or Electric Shut-off Device.—Outside of Building.**)—Every building within the city in which gas or electricity is used for illuminating, heating or other purposes shall be equipped with a device or devices which will enable firemen to shut off the supply of gas or current of electricity to any such building from the outside thereof; such device or devices to be placed at such a point or at such points on the outside of any such building as may be designated by the Fire Marshal of the city, and to be of such design and construction as to enable such device or devices to perform with reasonable certainty and safety the work required to be done thereby.

Any device or devices installed for the purpose of carrying out the provisions of this section shall first be approved by the Fire Marshal, and after the installation thereof the control of any such device or devices so installed in or upon any building under the provisions of this section shall be under the supervision of the Fire Department of the city.

Provided, however, that buildings used exclusively for residence purposes and outbuildings, sheds or barns attached or appurtenant to buildings used exclusively for residence purposes, shall be exempted from the provisions of this section.

Sec. 731. (**Penalty.**)—Any owner, agent or person having control or charge of any building coming within the provisions of the foregoing section, who shall neglect, fail or refuse to equip any such building with a device or devices such as are described in the foregoing section, shall be fined not less than fifty dollars nor more than two hundred dollars for each offense, and each day which shall elapse before the equipment of any such building with a device or devices as herein required shall be deemed a separate and distinct offense, and any person who shall disturb, meddle or tamper with any device or devices installed under the provisions of the preceding section, upon any building or buildings, without authority from the Fire Marshal, shall be fined not less than ten dollars nor more than one hundred dollars for each offense.

Sec. 732. (**License.—Contractors.**)—Every person or corporation engaged within the city in the construction or repairing of the whole or any part of buildings and appurtenances shall be and he or it is hereby required to obtain a license from the city which shall permit him or it to engage thereafter in the business of contracting for the erection of buildings and appurtenances or parts thereof.

Sec. 733. (**Application.—Conditions.**)—Amended by ordinance Nov. 25, 1907, to read as follows:

Every application for such license shall be made to the Commissioner of Buildings and shall set forth the name and residence or place of business of the applicant and the nature of the work which he or it desires to engage in for a period of one year thereafter, and shall be accompanied by a fee of five dollars.

Sec. 734. (**License to Be Issued.**)—Said Commissioner shall thereupon issue a license in due form, permitting the applicant to engage in the business of contracting for the erection of buildings and appurtenances, or parts thereof, in the city for

one year from the date of such license, which date shall be the first day of May in the year in which such license is applied for, and no license shall be granted for any period less than a year, and all licenses shall run from the first day of May in each year until the thirtieth day of April in the succeeding year.

Sec. 735. (Penalty.)—Any person or corporation who shall engage in the business of building in the city under contracts for the whole or any part of buildings and appurtenances, without first having obtained a license therefor as aforesaid, shall be fined not less than twenty-five nor more than one hundred dollars for each offense.

Sec. 736. (Walls.—Structures.—Buildings Altered to Conform to Chapter.)—No wall, structure, building or part thereof shall hereafter be built, constructed, altered or repaired within the city except in conformity with the provisions of this chapter. No building already erected or hereafter to be built within the city shall be raised, altered or built upon in such a manner that if such building were wholly rebuilt or constructed after the passage of this ordinance it would be in violation of any of the provisions of this chapter.

Sec. 737. (Buildings.—Expense of Altering Recoverable from Owner by City.)—Whenever, in the opinion of the Commissioner of Buildings, it shall be necessary to tear down, alter, repair or rebuild any building or portion of any building which is dangerous, defective or unsafe, or which is reported to the said Commissioner by the Commissioner of Health to be unfit for human occupancy, or which has been built in violation of any of the provisions of this chapter or of any ordinance regulating the construction of buildings hereafter passed, said Commissioner of Buildings shall cause such building or such portion thereof to be torn down, altered, repaired or rebuilt, or such work to be done thereon as he may deem necessary to render such building, or such portion thereof, safe or fit for human occupancy, and the expense thereof shall be recoverable from the owner or owners of such building by any proceeding that may be deemed appropriate.

Sec. 738. (Penalty.—Fines for Violation of Chapter.)—Any person or corporation who violates, neglects or refuses to comply with, or who resists or opposes the enforcement of any of the provisions of this chapter, shall be fined not less than twenty-five nor more than two hundred dollars for each offense, and every such person or corporation shall be deemed guilty of a separate offense for every day on which such violation, neglect or refusal shall continue; and any builder or contractor who shall construct any building in violation of any of the provisions of this chapter, and any architect designing or having charge of such building who shall permit it to be constructed, shall be liable to the penalties provided and imposed by this section.

AMENDMENTS

Passed March 1, 1909.

Be it ordained by the City Council of the City of Chicago:

Section 1. That it shall be unlawful for any person, firm or corporation to locate, build, construct or maintain on any lot fronting on any street or alley in the city, in any block in which one-half of the buildings on both sides of the street are used exclusively for residence purposes, any building or place used for a blacksmith shop, without the written consent of a majority of the property owners according to frontage, on both sides of such street or alley. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction of such building or place; provided, that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered.

Section 2. That portion of Section 692 of the Revised Municipal Code of Chicago of 1905, as subsequently amended relative to blacksmith shops, together with all other ordinances, or parts of ordinances, are hereby repealed in so far only as they are inconsistent with this ordinance.

Section 3. Any person, firm or corporation who shall violate any of the provisions of this ordinance shall be fined not less than five dollars nor more than one-hundred dollars for each offense.

Passed December 21, 1908.

Be it ordained by the City Council of the City of Chicago:

Section 1. It shall not be lawful for any person, firm or corporation to locate, build, or construct on any street or alley in the city in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, any building for a theatrical, dramatic or operatic entertainment, show, amuse-

ment, game or public exhibition of any kind, intended or calculated to amuse, instruct or entertain where such show, amusement, game or exhibition is given for gain, or for admission to which the public is required to pay a fee, without the written consent of a majority of the property owners according to frontage on both sides of such street or alley.

Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction of any such building; provided that in determining whether two-thirds of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street and located upon a corner lot shall not be considered.

Passed January 25, 1909.

Be it ordained by the City Council of the City of Chicago:

Section 1. That it shall hereafter be unlawful for any person, firm or corporation to locate, build or construct any building for a theatrical, dramatic or operatic entertainment, show, amusement, field game or public exhibition of any kind intended or calculated to amuse, instruct or entertain where daily entertainments, shows, amusements, games or exhibitions are given for gain or for admission to which the public is required to pay a fee, within two hundred (200) feet of any church or building used exclusively for educational purposes; said distance to be measured by the shortest route between the entrance to the building sought to be located, built or constructed and the entrance to such church or building used exclusively for educational purposes.

Roller Skating Rinks

Ordinance passed May 18, 1908.

Be it ordained by the City Council of the City of Chicago:

Section 1. That no room or hall used for the purpose of a roller skating rink shall be constructed, operated or maintained above the first floor of any building.

Sec. 2. This ordinance shall be in full force and effect from and after its passage.

PROVISIONS FOR MOVING PICTURE MACHINES.

Sections 2, 3, 4, 6, 7, 8, 9, 10, 11, 12 and 13 are omitted as not containing anything of special interest to architects or builders, only those portions of the ordinance being published which might have bearing on construction.

Be it ordained by the City Council of the City of Chicago:

Passed July 13, 1908.

Section 1. There is hereby established a Board of Examiners of moving picture operators, consisting of three members, who shall be appointed by the Mayor by and with the advice and consent of the City Council, and shall be subject to removal by the Mayor.

Sec. 5. All moving picture films, when not in use in the operating booth, shall at all times be kept in metal cases.

This ordinance was considered by the Committee on Buildings, recommended by it, and passed February 3, 1908.

Illuminated Roof Signs

Be it ordained by the City Council of the City of Chicago:

Section 1. That Chapter LXI, Article II of the Revised Municipal Code of Chicago of 1905 be and the same is hereby amended by inserting in said Chapter LXI, Article II, between Sections 2181 and 2182, Revised Municipal Code of Chicago of 1905, as amended July 2, 1906, a new section to be known as Section 2181a.

HOSPITALS.

An ordinance relating to hospitals within the City.

Ordinance passed June 1, 1908.

Sections 1103, 1104, 1105, 1109a, 1109 b, 1109c, 1109d, 1109e, 1109f are omitted as having no special bearing in construction of hospitals but containing requirements as to license and operation of interest to physicians and hospital management after the building is constructed.

Be it ordained by the City Council of the City of Chicago:

Section 1. That Section 690 of the Revised Municipal Code of Chicago of 1905, and Sections 279 and 691 of said Municipal Code as amended and now in force, be and the same are hereby repealed.

Sec. 2. That Article XIII of Chapter XXXII of the Revised Municipal Code of Chicago as amended February 26, 1906, be and the same is hereby amended to read as follows:

Sec. 1102. **(Hospitals and Maternity Hospitals—Definitions.)**—For the purpose

of this article a hospital is hereby defined to mean any institution or place used for the reception or care, temporary or continuous, of two or more sick, injured or dependent persons; or used for the treatment of two or more persons suffering from or afflicted with any mental or physical disease or bodily injury; including all hydro-
pathic and massage institutions.

For the purposes of this article a maternity hospital is hereby defined to mean any institution, or place used for the reception and care, temporary or continuous, of one or more women during pregnancy while awaiting confinement, during confinement, or for one month or less after confinement while recovering therefrom.

Unless otherwise specified, the word "hospital" as used in this article includes maternity hospital.

Sec. 1106. (Hospital Building Board.)—For the purposes of this ordinance there is hereby created a Hospital Building Board which shall be composed of the Commissioner of Health, the Commissioner of Buildings and the Chief Fire Marshal. The Hospital Building Board shall meet upon call of the Commissioner of Health and shall make such recommendations to the City Council as they may deem necessary or expedient for the construction and erection of new hospital buildings and for changes in buildings now being used or which may hereafter be used for hospital purposes.

Sec. 1107. (Accomodations for Patients.)—In every such hospital each room occupied or to be occupied by patients shall be of such dimensions as to give each patient not less than 800 cubic feet of space; every room shall have at least one window connecting with the external air for each two beds; said windows shall be of such dimensions as shall secure to each patient at least 2,400 cubic feet of fresh air per hour by natural ventilation, or in case said window shall not secure said 2,400 cubic feet of air per hour by natural ventilation, then each room shall additionally be fitted with such appliances for ventilation as shall secure to each patient in said room at least 2,400 cubic feet of fresh air per hour. Each bed shall have at least eighty square feet of floor space. In case of a maternity hospital, a regularly licensed physician must reside on the premises. Each ward or wing in said hospital shall have running water furnished in one or more places either in said ward or convenient thereto so that the same may be adequate and convenient to the occupants thereof; the plumbing, water closets, bath rooms and other sanitary appliances and conditions shall be constructed in accordance with the city ordinances relating to these matters. The building shall have the floor of the cellar properly cemented so as to be water tight; the halls of each floor shall be open to the external air with suitable windows and shall have no room or other obstruction at the end unless sufficient light or ventilation is otherwise provided for said hall and the building as a whole shall be provided with adequate and proper fire escapes, stairways or inclines or exits.

There shall be provided in each hospital building a suitable room or rooms approved by the Commissioner of Health to be used for the isolation of cases of contagious, infectious, epidemic or communicable diseases that may be found in the hospital until such time as the parties suffering from such contagious diseases shall be removed, in accordance with the rules and regulations of the Health Department; and a suitable room or rooms approved by the Commissioner of Health for the proper care of the dead pending their removal.

Sec. 1108. (Frontage Consents.)—It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage in any block in which two-thirds (2-3) of the buildings fronting on both sides of the street or streets on which the proposed hospital may front are devoted to exclusive residence purpose, any hospital for the care, treatment or nursing of two or more insane persons; or any hospital for the care, treatment or nursing of two or more inebriates, or person suffering from the effects of the excessive use of alcoholic liquors; or any hospital for the care, treatment or nursing of two or more epileptics; or any hospital for the care, treatment or nursing of two or more persons addicted to, or suffering from the excessive use of morphine, cocaine or other similar drugs or narcotics; or any hospital for the care, treatment or nursing of any person or persons affected with any contagious disease unless the owners of a majority of the frontage in such block, and the owners of a majority of the frontage on the opposite side or sides of the street or streets on which said building faces consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in said block. Such written consent of the majority of said property owners shall be filed with the Commissioner of Health before a permit shall be granted for the building or constructing, or a license be issued for the maintaining, conducting or managing of any such hospital.

Sec. 1109. (Location of Hospitals Near School.)—No hospital of any kind or description, shall hereafter be erected or established within four hundred (400) feet of any property used for public or parochial school purposes.

STEAM BOILER AND STEAM PLANT INSPECTION DEPARTMENT.

According to the Municipal Code, with code number and amendments to date.

Section 2204—**Department Established—Chief Inspector:** There is hereby established a department for the inspection of steam boilers and steam plants, the head of which shall be known as the Chief Inspector of Steam Boilers and Steam Plants.

Sec. 2205—**Appointment:** He shall be appointed by the Mayor by and with the advice and consent of the City Council.

Sec. 2206—**Qualification:** The person so appointed shall be well qualified from practical experience in the design or construction and operation of boilers, generators, and superheaters, and their appurtenances, used for generating steam for power, steaming or heating purposes, to enable him to judge of their safety for use as such. No person employed in the department created by this chapter shall be directly or indirectly interested in the manufacture, ownership, or agency of steam boilers or other apparatus or appliances used in the generation or use of steam, which are to be inspected.

Sec. 2207—**Bond:** The Chief Inspector of Steam Boilers and Steam Plants, before entering upon the duties of his office, shall execute a bond to the City of Chicago in the sum of five thousand dollars (\$5,000) with sureties to be approved by the Mayor, conditioned for the faithful performance of the duties of his office.

Sec. 2208—**Supervising Mechanical Engineer:** There is hereby created the office of Supervising Mechanical Engineer and Chief Deputy Inspector of Steam Boilers and Steam Plants. He shall be appointed by the Chief Inspector of Steam Boilers and Steam Plants according to law.

Sec. 2209—**Bond:** The Supervising Mechanical Engineer and Chief Deputy Inspector of Steam Boilers and Steam Plants, before entering upon the duties of his office, shall execute a bond to the City of Chicago in the sum of five thousand dollars (\$5,000), with sureties to be approved by the Comptroller, conditioned for the faithful performance of the duties of his office.

Sec. 2210—(Repeated July 8, 1907)—See Smoke Ordinance.

Sec. 2211—(Amended July 8, 1907)—**Board of Inspectors of Steam Boilers and Steam Plants—to inspect City and Board of Education Boilers:** The department of steam boilers and steam plants shall have the same power over all steam boilers and steam plants owned or operated by the city or Board of Education as over all other steam boilers and steam plants in said city; and all steam boilers or steam plants owned, operated or controlled by the city or the board of education of said city shall be subject to the requirements of this chapter; and it shall be the duty of said department to inspect at least once in each year all of such steam boilers and steam plants as are owned, operated or controlled by the city or said Board of Education, and also to preserve a record of the condition of such steam boilers or steam plants as shown by such inspection. No fee shall be charged or paid to said department nor to any employe under said department for the inspection of any steam boiler or steam plant or for the certificate of inspection issued by said department for any steam boiler or steam plant owned, operated or controlled by said city.

Sec. 2212—(Amended July 8, 1907)—**Duties of the Board:** It shall be the duty of the department to inspect all boilers, tanks, jacket kettles, generators or other apparatus used for generating or transmitting steam for power, or using steam under pressure for heating or steaming purposes, and all other tanks, jacket kettles, and reservoirs under pressure of whatsoever kind, except as hereinafter provided, as often as once in each and every year, by making a hydrostatic pressure test where such tests shall be deemed necessary; Provided, that the hydrostatic pressure used in such test shall not exceed the maximum working pressure of said apparatus by more than fifty per cent; and by making a careful external and internal examination. In all cases where hydrostatic pressure test is used an internal examination of said apparatus shall afterwards be made. In certifying the working pressure allowed on each steam generator or other apparatus the same shall be determined by multiplying one-fifth of the lowest tensile strength of any plate in the cylindrical shell of said steam boiler or steam generator or other apparatus by the lowest efficiency of joint in such cylindrical shell expressed in decimals, and by multiplying the product by the thickness, expressed in inches or parts of an inch, of the thinnest plate in the same cylindrical shell and divide by the radius, also expressed in inches. This sum will be the pressure allowable per square inch of surface.

Any boiler, tank, jacket kettle, generator or reservoir having been in use eight years or more and its condition being such that in the opinion of the inspector the same should be drilled in order that the exact thickness and condition may be ascertained, he shall report the same to the Chief Inspector of Steam Boilers, who shall

serve the owner or agent with a written notice to show cause to the Chief Inspector within five days why such boiler, tank, jacket kettle, generator or reservoir should not be drilled.

If, after the owner or agent has been heard, or at the end of five days, the Chief Inspector deems it necessary that the boiler, tank, jacket kettle, generator or reservoir be drilled, then the boiler, tank, jacket kettle, generator or reservoir may be drilled at points near the water line, and at the bottom of shell of boiler, or such other points in the boiler, tank, jacket kettle, generator or reservoir as the inspecting officer may direct, and the thickness of said material shall be determined thereafter at such annual inspection as the inspecting officer may deem necessary, and the steam pressure or other pressure allowed shall be governed by such ascertained thickness and general condition of boiler, tank, jacket kettle, generator or reservoir. And the drilling and plugging of said holes shall be done at the expense of the owner.

Any boiler may be tested and rated in accordance with the United States Marine Inspection Law governing the inspection of steam boilers. But no boiler, tank, jacket kettle or jacket constructed or reconstructed of boiler plates hereafter, where the same are required shall have stay bolts of less than seven-eighths of an inch in diameter and pitched more than seven inches apart. All stationary boilers, tanks, jacket kettles or jackets carrying a pressure of one hundred pounds or over to the square inch, the construction of which requires stay bolts, shall be equipped with hollow stay bolts. All boiler heads made of boiler plate shall be braced with braces, the sectional area of which shall not be less than one square inch each, so pitched that a greater strain than six thousand pounds per square inch of section shall not be carried by any one brace or stay bolt. In computing the strain on braces in flat surfaces the diameter of brace rivets shall be considered. In computing the strain on shells having dished heads the pressure will be figured according to the radius of the heads.

It shall be the duty of the department to see that the boiler or boilers, boiler setting, means of producing draft, smoke connections and furnace or fire box of each boiler inspected by it are of sufficient capacity or so constructed as with proper management to avoid the issuance or emission of dense smoke from any chimney or smokestack connected therewith.

Sec. 2213—(Repealed July 8, 1907): See Smoke Ordinance.

Sec. 2214—Repealed by City Council January 22, 1906.

Sec. 2215—(As amended January 2, 1906)—**Prosecutions for Violations—by Whom to Be Instituted:** Provides that prosecutions for all violations of above section shall be instituted by the Chief Inspector of Steam Boilers and Steam Plants or his deputy in the name of the City of Chicago.

Sec. 2216—(Amended July 8, 1907)—**Permit for New Plants, Plans, Etc.:** No new plants, nor any reconstruction of any old plants, for producing power and heat, or either of them shall be erected or maintained in the city until the plans and specifications of the same have been filed in the office of and approved and a permit for such erection or construction issued by the Chief Inspector of Steam Boilers and Steam plants, which plans and specifications shall show the amount of work and the amount of heating to be done by such plant and all the appurtenances thereto, including provisions for the complete combustion of the fuel to be used and a statement of the kind of fuel proposed to be used. Such plans and specifications shall also show that the room or apartment in which such plant shall be located is provided with doors, windows, air-shafts, fans, and other means of ventilation sufficient to prevent the temperature of such room, apartment, basement or other portion of such building wherein such steam plant or apparatus is to be used, from rising to a point higher than one hundred and twenty degrees Fahrenheit, or that the atmosphere of any such apartment wherein such apparatus may be located may be entirely renewed every ten minutes. Upon approval of such plans and specifications, a duplicate set of which shall be left on file in said office, and the payment of fees as hereinafter provided, and upon the presentation to the department of a permit issued by the department of smoke inspection, said Chief Inspector shall issue a permit for the installation of such plant or such reconstruction. Such permit shall state the maximum amount of steam pressure to be carried. As soon as the department hereby created has examined the plans and specifications submitted for a new steam plant in a new building and has issued a permit for the installation of same it shall notify the Commissioner of Buildings to see that the execution of the construction work on the building in which such plant is to be installed is carried out in conformity with the plans and specifications of the proposed steam plant for the execution of which a permit has been issued, with special reference to the amount of space to be used for such appurtenances, the size and construction of the chimney or chimneys to be used, and the provisions for ventilation and proper temperature in the engine and boiler room.

It shall be the duty of the Supervising Mechanical Engineer and Chief Deputy

Inspector of Steam Boilers and Steam Plants to examine in detail all plans and specifications that may be submitted to the department, and to report upon the same for approval by the department.

Sec. 2217—(Amended July 8, 1907)—**Duty of Owners:** It shall be unlawful for any person to use any steam boiler or any tank or tanks subject to pressure other than city pressure, until he shall have first procured a certificate from said Chief Inspector that such apparatus may be safely used, and that the boiler or boilers, boiler setting, means of producing draft, smoke connections and furnace or fire box are of such size and capacity that they will do the work required, and be capable of being so managed for the purpose of generating steam that no dense smoke shall be emitted from the chimney connected with such furnace or fire box.

If such owner, agent or person using a steam boiler or tank shall fail to notify said Chief Inspector of his intention to make any alteration, repairs or enlargement of such steam plant, and shall fail to file plans and specifications for the enlargement or alterations of the same, and shall proceed to make such alteration, repairs or enlargement without a permit therefor, he shall be liable to a fine of twenty-five dollars for each day on which he shall have prosecuted such alteration, repairs or enlargement without said permit, and each day's violation shall constitute a separate offense. Provided, however, that minor necessary or emergency repairs which do not increase the capacity of such apparatus or involve any substantial alteration of structure may be made by or under the engineer in charge of such apparatus without permit or report thereof.

If at any time when inspecting a steam boiler, generator or other apparatus used for generating steam for power or heating purposes the inspector of boilers shall find that the furnace or fire box in which fuel is used for the purpose of generating steam is so constructed or operated as to cause the emission of dense smoke from the chimney connected therewith he shall report to the department of smoke inspection the condition of such plant.

Provided, that any boilers for heating purposes only, in which the permit specifies that not more than ten pounds of steam pressure to the square inch shall be carried, shall be known as "low pressure boilers."

After the next inspection of such low pressure boilers shall have been made following the adoption of this ordinance, inspections thereafter shall be made once in every three years. But all of such low pressure plants may be inspected at any time thereafter and without charge, with reference to the provisions for draft, complete combustion or degree of combustion of fuel and prevention of the emission of smoke.

Sec. 2218—**Exceptions:** The provisions of this chapter relating to the inspection of boilers, generators or other apparatus carrying other than city pressure shall not apply to such boilers, generators or apparatus while in use or installed in any locomotive, steam or tug boat. The provisions of this chapter relating to the inspection of steam boilers, generators or other apparatus carrying other than city pressure shall be held to apply to any such steam boiler, generator or apparatus in use or installed in any steam roller, steam derrick, steam pile driver, automobile or other movable structure or contrivance of any kind whatsoever used within the city. Provided, however, that this ordinance shall not apply to boilers, generators or other apparatus used in private residences for generating steam solely for heating purposes; and for the purpose of this ordinance flat buildings or apartment buildings with more than three apartments shall not be classed as private residences, and any steam boiler, generator or other apparatus used for generating steam in flat buildings or apartment buildings having more than three flats or apartments shall be subject to inspection as hereinbefore provided.

Sec. 2219.—**Certificate—Record:** When an inspection of a boiler or boilers, tank or tanks, jacket-kettle, generator or generators, superheater or superheaters, or any apparatus under pressure, has been made, and the same shall be approved by the Chief Inspector or Supervising Mechanical Engineer and Chief Deputy Inspector of Steam Boilers and Steam Plants, he shall make and deliver to the person for whom the inspection was made, upon the payment of the fees hereinafter mentioned, a certificate of such inspection, which shall contain the date of inspection, together with a general description, for what purpose used, the number of try-cocks, steam and water gauges, the pounds pressure at which they may be safely used; which certificate shall be framed and put up in a conspicuous place in the engine or boiler room, and a record of the same shall be made and kept by said Board, in a well-bound book or books, indexed alphabetically or by locality.

Sec. 2220—See Smoke Ordinance.

Sec. 2221—**Inspection of Repairs:** It shall be the duty of said Inspector, upon an application in writing made by any person, firm, corporation, or agent, owning, leasing or controlling the use of any boiler, tank, jacket-kettle, generator, or superheater, stating that the same is out of repair or has been repaired, to examine the same when so repaired, and determine if such repairing has been properly done; and it shall be

unlawful for any person, firm, corporation, or agent to use any boiler, tank, jacket-kettle, generator, or superheater, after the same has been repaired, until a certificate shall have been procured from the Inspector to the effect that such repairing has been properly done, and such boiler, tank, jacket-kettle, generator, or superheater may be safely used, except as hereinbefore provided in this chapter.

Sec. 2222—**Fees:** The fees for inspection of steam boilers and other apparatus under this chapter shall be as follows:

Class A. Including steam boilers, tanks, jacket-kettles, of a capacity of seventy-five gallons or over, generators, or other apparatus under a pressure exceeding ten pounds per square inch in plants where only one such apparatus is used, five dollars each.

Class B. Steam boilers, generators, or superheaters under pressure exceeding ten pounds per square inch in plants where more than one such is used, five dollars for the first and three dollars for each additional apparatus.

Class C. Tanks and jacket-kettles, of a capacity of seventy-five gallons or over, under pressure in plants where more than one such tank or jacket-kettle is used, one dollar each for all after the first.

Class D. All low-pressure steam boilers as herein described in this chapter, three dollars each.

Class E. The fee for a permit for a new steam plant or for additions to an old plant shall be five dollars for each boiler or tank to be used under pressure or for the addition or rebuilding of any smokestack or chimney or for any material alteration or change made in such plant. The fee for the inspection of steam boilers and other apparatus above provided for shall be double the respective amounts above specified when an inspection is made on Sunday or any legal holiday at the request of the person or corporation owning or operating said steam boilers or other apparatus.

All fees provided for in this chapter shall be paid to the City Collector.

Sec. 2223—(Amended July 8, 1907)—**Exemptions—Charitable, Religious and Educational Institutions:** Said Chief Inspector may, and he is hereby directed and instructed to remit all inspection fees charged, or that may hereafter be charged, against any and all charitable, religious, and educational institutions, when the boiler or other apparatus inspected is located in or upon premises used or occupied exclusively by such charitable, religious or educational institution; Provided, that such charitable, religious or educational institution is not conducted or carried on for private gain or profit, and provided further, that said Chief Inspector may require every application for the remission of such fees to be verified by the affidavit of one or more tax-payers of the city.

Sec. 2224—**Charging Excess Fees:** If any person acting on behalf of the city under the provisions of this charter shall take or receive any money or any valuable thing for the purpose of deceiving or defrauding any person or persons, or for the purpose of favoring any person or persons, or if any inspector shall recommend the issue of any certificate of inspection without having at the time stated thoroughly examined and tested the boiler so certified, he shall be fined one hundred dollars (\$100) for each offense.

Sec. 2225—(Amended July 8, 1907)—**Try-cocks, Gauges, Force Pumps:** It shall be the duty of every person or corporation owning, leasing or controlling the use of any steam boiler or boilers, subject to inspection, as hereinbefore provided, to provide and properly affix to each and every one of such boilers a full complement of try-cocks, one water gauge, one fusible plug of good Banca tin, one or more pop safety valves (the area of pop valves shall be in the ratio of one square inch to three square feet of grate surface): Provided, that on boilers used for generating steam for heating purposes only and carrying not more than ten pounds steam pressure, direct weighted safety valves may be used. On each steam boiler or steam generator, or other apparatus subject to inspection, there shall be placed a suitable shut-off or main stop valve so placed as to prevent the water passing into the heating apparatus during the test made at the time of inspection; Provided, that shut-off or main stop valves shall be required only in plants to be hereafter installed, and a good and sufficient force pump or other means of supplying the boiler with water; also a good and sufficient safety valve or reducing valve to all tanks or jacket kettles, properly attached. No stop or shut-off valve shall be placed between a boiler, tank or jacket kettle and the safety valve.

After inspection the inspector shall seal all safety valves, and said seal shall not be broken, except by authority of said department, except in case of emergency, and when the seal is broken a complete report of the same shall be made to said department within twenty-four hours; and said valve shall be resealed forthwith by said department without charge, provided the circumstances of the breaking of said seal are approved by said department.

Sec. 2226—**Owners to Provide Facilities:** Every person owning or having possession or control of any steam boilers, tanks, jacket-kettles, generators, or superheaters, subject to inspection as aforesaid, shall provide at his own expense proper

arrangements and facilities for attaching the instruments of inspection. Immediately before the time set for such inspection, every person shall remove all scale, dirt, soot, and sediment in, beneath, and around such boiler, shall fill the same with water, when so directed by the Inspector, and have all main stop valves and other valves and connections on said boiler or boilers perfectly tight, so that the Inspector may be able to apply hydrostatic pressure, leaving all said apparatus in clean condition for inspection.

Sec. 2227—**Engineer's Negligence, Maximum Pressure, and Safety Valves:** Any engineer or other person in charge of a steam boiler or generator who shall negligently or wrongfully endanger the life of any person by permitting the water to fall below three inches above the flues or crown sheet of any boiler, or shall disturb the spring or weight on the safety valve, or break the seal of the safety valve, or tamper with it so as to carry more pressure than allowed by the Inspector, or who shall otherwise neglect his duties, shall be subject to a fine of not less than \$25 nor more than \$100 for each offense and it shall be the duty of the Chief Inspector to report the facts to the Board of Examining Engineers.

The safety valves of steam boilers shall not be loaded to sustain more than the maximum pressure allowed by said Inspector, and the area of the discharge of each safety valve shall be equal to the full area of the valve, and all safety valves shall be directly open to the atmosphere.

Sec. 2228—(Amended July 8, 1907)—**Manufacturers and Dealers—Notify Inspectors:** Any person or corporation manufacturing, dealing in, selling or erecting steam boilers, tanks, jacket kettles, or generators, subject to inspection under this chapter, shall, on the sale or delivery of such steam boiler, tank, jacket kettle, or generator at any point or locality within the city, notify the said Chief Inspector, giving the name of the owner, name of maker, number and name of street, or otherwise designate the locality of said delivery or sale; shall state also the thickness and quality of the material used in the construction and the brand stamped on the plate.

Sec. 2229—**Second-Hand Dealers:** All steam boiler manufacturers, second-hand steam boiler and junk dealers, and any other person selling second-hand steam boilers, tanks, jacket-kettles, generators, or superheaters, shall before painting the same have them inspected by the Department of Steam Boiler and Steam Plants, and have in their possession a certificate issued by said Department, showing the amount of pressure per square inch the said steam boiler, tank, jacket-kettle, generator or superheater is allowed to carry before offering for sale any second-hand steam boiler, tank, or jacket-kettle, generator, or superheater, and give the buyer the said certificate of inspection. Any person or corporation violating this section shall be fined not less than ten dollars (\$10), nor more than one hundred dollars (\$100), for each offense.

Provided that any person or persons disposing of a second-hand steam boiler, tank, jacket-kettle, generator, or superheater, which has been in use, shall not be required to secure inspection if said steam boiler, tank, jacket-kettle, generator, or superheater is sold to a dealer in or repairer of such apparatus, but such inspection shall be had before such articles are sold for use.

Sec. 2230—**Penalty:** Any person who shall violate any of the provisions of this chapter shall be fined not less than twenty-five dollars (\$25), nor more than one hundred dollars (\$100), for each offense.

Sec. 2231—(Amended July 8, 1907)—**Apparatus—Record:** The city shall provide such instruments, books, papers, and equipment as shall be necessary for the proper performance of the duties of such department, which shall be the property of said city, and which shall be delivered by said Chief Inspector to his successor in office. Said Chief Inspector shall report annually on or before the first day of February to the Mayor and City Council, and as often as required by said Council.

Said department shall prepare and keep in its office a record of each steam boiler, steam generator, tank, jacket-kettle, or other apparatus used for the generation of steam or under pressure other than city pressure, and at the first inspection of any such apparatus under and by virtue of this chapter a number shall be securely stamped upon the same with a steel stamp or die, of not less than one-half inch in height, in a conspicuous and easily accessible place upon said apparatus, which number shall be the office number of such piece of apparatus, and the designation by which the same shall be known in said record after such inspection; and said record shall contain a full description of such piece of apparatus, together with the use for which it is employed, the place where it may be located, the name of the owner, agent, or lessee of said apparatus, together with the amount of pressure allowed by the Inspector for the same, and the kind of fuel used, together with the number of try-cocks, steam and water gauges, and any special information pertaining thereto, including a record of inspections made.

Sec. 2232—(Amended July 8, 1907)—**Report Defects in Furnaces and Smokestacks:** It shall be the duty of the assistant inspectors to report to said Chief Inspector defects in furnaces and smoke-stacks as well as in boilers.

Section 1, 2, 3, 4, 5 and 6 of an ordinance passed December 16, 1907, relate solely to maintenance and inspection of Cooling Plants, etc., and are omitted as having no bearing on construction.

SMOKE INSPECTION DEPARTMENT

Providing for smoke inspection and abatement in the City of Chicago.

Section 1. There is hereby established a department of smoke inspection, the head of which shall be known as the Smoke Inspector.

Sec. 2. The Smoke Inspector shall be appointed by the Mayor by and with the advice of the City Council.

Sec. 3. The person so appointed shall be a mechanical engineer, qualified by technical training and experience in the theory and practice of the construction and operation of steam boilers and furnaces and also in the theory and practice of smoke abatement and prevention.

Sec. 4. The Smoke Inspector, before entering upon the duties of his office, shall execute a bond to the City of Chicago in the sum of ten thousand dollars, with sureties to be approved by the Mayor, conditioned upon the faithful performance of the duties of his office.

Sec. 5. The salary of the Smoke Inspector shall be four thousand (\$4,000) dollars per annum.

Sec. 6. There is hereby created the office of chief assistant smoke inspector, who shall be appointed by the Smoke Inspector as provided by law.

Sec. 7. The qualifications of the chief assistant smoke inspector shall be the same as the qualifications herein provided for the Smoke Inspector.

Sec. 8. The chief assistant smoke inspector shall, before entering upon the duties of his office, execute a bond to the City of Chicago in the sum of five thousand dollars (\$5,000), with sureties to be approved by the Mayor, conditioned upon the faithful performance of the duties of his office.

Sec. 9. The salary of the chief assistant smoke inspector shall be three thousand (\$3,000) dollars per annum.

Sec. 10. There shall be as many deputy smoke inspectors as shall be provided for by the City Council; their compensation shall be fixed by the City Council and they shall be appointed by the Smoke Inspector in the manner provided by law.

Sec. 11. There shall be as many assistant smoke inspectors as shall be provided by the City Council; their compensation shall be fixed by the City Council and they shall be appointed by the Smoke Inspector in the manner provided by law.

Sec. 12. There shall be as many clerks and stenographers assigned to this department as shall be provided by the City Council; their compensation shall be fixed by the City Council and they shall be appointed by the Smoke Inspector in the manner provided by law.

Sec. 13. The Mayor may in his discretion appoint a Smoke Abatement Commission composed of eight members who shall act as advisors to the Mayor in the organization of the department and as advisors to the Smoke Inspector in the conduct of the department. The Smoke Inspector shall at all times receive, place and keep on file in his office any suggestion, recommendation, advice or other communication which may be presented to him in writing by the Smoke Abatement Commission. The Smoke Abatement Commission may name an advisory board of mechanical engineers which shall consist of three consulting engineers of recognized ability and integrity who have had experience in the installation and conduct of power and heating plants. This board shall act as advisors on engineering questions to the Smoke Abatement Commission and to the Smoke Inspector and to the members of the department. Meetings of the advisory board of mechanical engineers may be called at any time either by the Smoke Abatement Commission or by the Smoke Inspector. Members of the advisory board of mechanical engineers shall receive as their compensation the sum of ten dollars (\$10) for each member for each regularly called meeting attended.

Sec. 14. No new plants or any reconstruction of any old plants for producing power and heat, or either of them, or any new chimney connected with a steam plant shall be erected or maintained in the city until plans and specifications of the same have been filed in the office of and approved by the Smoke Inspector and a permit issued by him for such erection, reconstruction or maintenance. Plans and specifications to be filed with the Smoke Inspector shall show the amount of work and the amount of heating to be done by such plant and all appurtenances thereto, including all provisions made for the purpose of securing complete combustion of the fuel to be used and for the purpose of preventing smoke; said plans and specifications shall also contain a statement of the kind of fuel proposed to be used, and said plans and specifications shall also show that the room or apartment in which such plant shall be located is provided with doors, windows, air-shafts, fans and other means of ventilation sufficient to prevent the temperature of such room, apartment, basement or other portion of such building wherein such steam plant or apparatus is to be used, from rising to a point higher than 120 degrees Fahrenheit, and sufficient also to provide that the atmosphere of any such apartment, wherein such apparatus may be located, may be entirely renewed every ten minutes. Upon the approval of such plans and specifications, a duplicate set of which shall be left on file in said office, and upon the payment of the fees as hereinafter provided, the Smoke Inspector shall issue a permit for the reconstruction, erection or maintenance of such plant. As soon as the Smoke Inspector has examined the plans and specifications submitted and has issued a permit as above provided, he shall then notify the Commissioner of Buildings to see that the execution of the work permitted is carried out in conformity with the plans and specifications, with special reference to the amount of space used, the size and construction of the chimney or chimneys used, the provisions for the prevention of smoke, and the provisions for ventilation, and for the proper temperature in the engine and boiler rooms.

Sec. 15. It shall be unlawful for any person to use any new or reconstructed plant for the production and generation of heat and power, or either of them, until he shall have first procured a certificate from the Smoke Inspector that the plant is so constructed that it will do the work required and that it can be so managed that no dense smoke shall be emitted from the chimney connected with the furnace or firebox.

Sec. 16. No owner shall alter or repair any chimney or any old furnace or device which alteration, change or installation shall affect the method or efficiency of preventing smoke, without first submitting plans and specifications to the Smoke Inspector and securing a permit therefor, provided, however, that minor necessary or emergency repairs which do not increase the capacity of such plant or which do not involve any substantial alteration in structure and which do not involve any alteration in the method or efficiency of smoke prevention may be made by or under the engineer in charge of said plant without a permit. Any person who shall violate this section shall be liable to a fine of \$25.00 for each day upon which he shall prosecute such alteration, change or installation without a permit, and each day's violation shall constitute a separate offense.

Sec. 17. The emission of dense smoke within the city from the smokestack of any locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle or other similar machine or contrivance, or from the smokestack or chimney of any building or premises, excepting for a period of six minutes in any one hour during which the fire box is being cleaned out or a new fire being built therein, is hereby declared to be a nuisance and may be summarily abated by the Smoke Inspector or by any one whom he may duly authorize for such purpose. Such abatement may be in addition to the fine hereinafter provided. Any person or persons, or corporation, owning, operating or in charge or control of any locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle, or other similar machine or contrivance, or of any building or premises, who shall cause or permit the emission of dense smoke, within the city, from the smokestack, or chimney of any such locomotive, steam boat, steam tug, steam roller, steam derrick, steam pile driver, tar kettle or other similar machine or contrivance, or from the smoke stack or chimney of any building or premises so owned, controlled or in charge of him, her or them, except for a period of six minutes in any one hour during which the fire box is being cleaned out or a new fire built therein, shall be deemed guilty of a violation of this ordinance, and upon conviction thereof shall be fined not less than ten dollars (\$10.00) nor more than one hundred dol-

lars (\$100.00) for each offense; and each day of such emission of dense smoke shall constitute a separate offense.

Sec. 18. The fees for the inspection of plans and issuing of permits and for the inspection of plants and issuing of certificates shall be as follows:

For inspecting plans of new plants and plants about to be reconstructed, \$2.00.

For inspecting plans for report and alterations, \$1.00.

For examining a plant after its erection or reconstruction and before its operation and maintenance, \$3.00.

The fee paid for the inspection or examination shall include the issuing of a permit or certificate, in case such permit or certificate is granted.

The Smoke Inspector may and he is hereby directed and instructed to remit all inspection or examination fees charged, or that hereafter may be charged, against any and all charitable, religious and educational institutions when the furnace or other device or apparatus inspected is located in or upon premises used and occupied exclusively by such charitable, religious or educational institution; provided, that such charitable, religious or educational institution is not conducted or carried on for private gain or profit; and, provided further, that the Smoke Inspector may require every application for the remission of such fees to be verified by the affidavit of one or more tax payers of the city.

Sec. 19. Prosecutions for all violations of this ordinance shall be instituted by the Smoke Inspector and shall be prosecuted in the name of the City of Chicago.

The issuance and delivery by the Smoke Inspector of any permit or certificate for the construction or reconstruction, or any permit for the alteration or repair of any plant or chimney connected with a plant, shall not be held to exempt any person or corporation to whom any such permit has been issued or delivered, or who is in possession of any such permit, from prosecution on account of the emission or issuance of dense smoke caused or permitted by any such person or corporation.

Sec. 20. Any person who shall violate any of the provisions of this ordinance (except as is herein otherwise provided) shall be fined not less than \$25.00 nor more than \$100.00 for each offense.

Sec. 21. The city shall provide such instruments, books, papers and equipment as shall be necessary for the proper performance of the duties of the members of the department. The Smoke Inspector shall have charge of such instruments, books, papers and equipment, and shall deliver the same to his successor in office.

Sec. 22. The Smoke Inspector shall cause to be kept in his office a complete record of all plans submitted and of all permits issued and of all examinations of plants made by members of the department and also of all certificates issued.

Sec. 23. The Smoke Inspector shall make a report of the work of his department to the Mayor and City Council, annually, on or before the first day of February, and at other times as often as required by the City Council.

Sec. 24. If any person acting on behalf of the city under the provisions of this chapter shall take or receive any money or any valuable thing for the purpose of deceiving or defrauding any person or persons, or for the purpose of favoring any person or persons, or if any inspector shall recommend the issue of any certificate of inspection without having at the time stated thoroughly examined and tested the furnace, device or apparatus so certified, he shall be fined one hundred dollars for each offense.

Sec. 25. Chapter LXIV of the Revised Municipal Code of Chicago of 1905, as amended, so far only as said chapter refers to smoke inspection, is hereby repealed and the position of Chief Smoke Inspector created by said chapter is hereby abolished.

Sec. 26. This ordinance shall take effect on and after its passage and publication.

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SIDEWALKS AND VAULT COVERING

SYNOPSIS OF SPECIFICATIONS FOR CONCRETE AND STONE SIDEWALKS, AND FOR WALKS LAID OVER VAULTS, ETC., FROM ORDINANCE PASSED MARCH 23, 1904.

Requirements of the City as to quality of work, etc., must be observed under penalty.
Walks Laid on Filling.

Prepare foundation by cutting down or filling up to a sub-grade 14 inches below final sidewalk grade. Where filling is necessary it shall be of earth or cinders, or other material equally good, free from animal or vegetable matter, placed to leave a berme of one foot on each side of and flush with the top of the completed walk (except where the walks are laid full width of the sidewalk space), and shall slope to the natural surface $1\frac{1}{2}$ feet horizontal to 1 foot vertical. Where necessary the foundation must be compacted until solid. Soft places must be dug out and refilled and thoroughly compacted. Upon this sub-foundation lay cinders, 9 inches in depth after being flooded and thoroughly tamped. Upon this foundation place a layer of hydraulic cement concrete $4\frac{1}{4}$ inches thick, with top finish $\frac{3}{4}$ inches thick, composed as follows:

Concrete Mixed with Sand.

One part of cement equal in quality to the best Portland, $2\frac{1}{2}$ parts of clean torpedo sand, ranging from $\frac{1}{8}$ inch down to the finest, and 5 parts of crushed limestone, or other stone equally as good, or washed gravel, all free from dust and dirt or other foreign substances, and not less than $\frac{1}{4}$ inch or more than 1 inch in any dimension. The cement and sand shall be thoroughly mixed dry, after which it shall be moistened with water and made into a stiff mortar. The crushed stone or gravel to be sprinkled with water, then incorporated in the mortar and the mass thoroughly mixed by turning over with shovels, hoes, or mixers at least three times, and then placed on the foundation and rammed until solid.

The finishing layer, $\frac{3}{4}$ of an inch thick, 2 parts of cement equal in quality to the best Portland and 3 parts clean torpedo gravel or granite screenings put on before the first layer has set, and troweled to give the walk a smooth, even and glossy surface.

Space at Curb: A space of $1\frac{1}{2}$ inches between all walks and the curb at street and alley intersections.

All mixing to be done on water-tight platforms.

All work on 5, 6, 10, 12, 15, 18, 20, 24 and 25 foot walks to be laid out in blocks 5 feet by 6 feet in size; on all other widths the stones to be uniform and to have a surface of not less than 24 square feet nor more than 36 square feet.

All walks to be laid on a line 1 foot from and parallel with the lot line unless ordered by special ordinance.

WALKS LAID OVER VAULTS, ETC.

Beam Work.

Substructure: Steel I beams set not more than 5 feet centers, the outer end to rest 8 inches on curb wall and be firmly bedded in masonry to the top flange. Where practicable the inner end of beam to penetrate the building wall 6 inches. Whenever beams rest on an area wall, and the clear span between bearing points exceeds 9 feet, wall must not be less than 12 inches thick.

Where no area or building wall exists cross beams shall rest on or be framed into a girder beam and fastened to same with proper angles and thoroughly bolted or riveted. All intersecting or girder beams to be 1 inch deeper than the cross beams, which are to rest on or be framed into them.

Said girder beams to be supported by circular cast iron columns, not more than $8\frac{1}{2}$ feet apart from centers, and not less than 5 inches external diameter and metal not less than $\frac{1}{2}$ inch thick, free from blow-holes and defects.

Columns to rest on 12 by 12 inch iron plates 1 inch thick, firmly bedded in a concrete foundation not less than 18 inches thick and having a surface bearing not less than 4 square feet. The top of column shall have a square plate 1 inch thick, fitted with a shoe formed in same, in which the girder beam shall rest. Columns over 10 feet to be $\frac{3}{4}$ inch metal, and 6 inches external diameter.

The top of the completed iron substructure shall be parallel with and 4 inches below top of finished walk.

The following sized steel cross beams shall be used:

| Span in Feet. | Beams Deep in Inches. | Weight per Ft., lbs. |
|---------------|-----------------------|----------------------|
| 6 and 7 | 6 | $12\frac{1}{4}$ |
| 8 | 7 | 15 |
| 9 and 10 | 8 | $17\frac{3}{4}$ |
| 11 and 12 | 9 | 21 to 25 |
| 13 | 10 | 25 |
| 14, 15 and 16 | 12 | $31\frac{1}{2}$ |
| 17 and 18 | 12 | 40 |
| 19 and 20 | 15 | 42 |

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If necessary to change spacing between beams or use a beam of different depth than specified, the spacing shall be so changed, or such beam shall be of sufficient weight to give it bearing strength equal to the beam specified.

Concreting: Between the beams set in place and securely fastened to the lower flange, shall be placed temporary centers, smooth on the upper surface, which shall be removed when the concrete is set, the top or crown of same shall be two inches below the top of the steel cross beams.

Upon the above forms shall be placed the concrete, composed of the same kind of material, in the same proportions, etc., as the concrete specified for sidewalks, especial care being given to tamping and ramming, and brought to a grade three inches above the top of the steel substructure and 1 inch below and parallel with the top of the completed walk. The finishing layer, 1 inch thick, composed of two parts of cement, equal in quality to the best Portland, and 3 parts screened torpedo gravel, or granite screenings, to be put on before the first layer has set, and troweled sufficiently to give the walk a smooth, even and glossy surface, joints to be formed over the center of each I beam in the concrete as well as in the top dressing, and extend over the curbing down to the pavement.

Any system or method of vault construction equal to the above system may be used in lieu thereof, but in all cases any plans calling for beams or a construction of a size or character different from the above sizes and weights must be submitted to the Commissioner of Public Works for approval before construction is commenced and must be capable of sustaining a distributed safe load of 300 pounds per square foot, including weight of walk.

A stamp or plate giving the name and address of the contractor or person building the walk and the year in which the work was done. The top of said plate or stamp must not cover more than 54 square inches of surface, shall be flush and even with the top of the finished walk and must be of a permanent character.

Wherever one contractor or person has laid walks in front of three or more adjoining lots in one stretch, one of the stamps placed at each end of stretch of walk will be sufficient.

Slope: All sidewalks to be so constructed that the grade shall be a uniform incline, with a fall of 1 inch in every 3 feet.

Curbage: The curbage shall have a top dressing 1 inch thick, and shall extend 4 inches below the top of the pavement. When finished it shall present a true and perfectly plumb appearance; all joints to be straight and clean cut.

Driveways shall conform to the sidewalk grade and shall be 9 inches in depth, consisting of a layer of concrete 7 inches in depth and a finishing layer of 2 inches. Work to be as specified for Portland concrete walks.

Stone Sidewalks shall be constructed of the best quality of limestone, quarried a sufficient time to be seasoned and thoroughly frost proof. Stone to be free from cracks, etc., sawed or planed, with full joints grooved for $1\frac{1}{4} \times \frac{3}{8}$ inch iron bars, the ends to be full and heads dressed to a uniform thickness. No stone to be less than $4\frac{1}{2}$ feet wide and of the following thicknesses:

For walks 8 feet wide the stone shall be not less than 6 inches thick.

For walks 10 feet wide the stone shall be not less than 8 inches thick.

For walks 12 feet wide the stone shall be not less than 10 inches thick.

For walks 14 feet wide the stone shall be not less than 12 inches thick.

For walks 16 feet wide the stone shall be not less than 14 inches thick.

Stones to be bedded on the curb wall on the outside and inside on 6x8 inch iron lintels of $1\frac{1}{4}$ inch metal, supported by circular cast iron columns not less than 8 feet in length set not more than 8 feet apart from centers; on foundation of stone not less than 12 inches deep, and having a surface bearing of not less than 4 square feet. Columns to be of the best quality of cast iron, free from all defects, of the following sizes external diameter:

For walks 8 feet wide or less 4 inch columns of $\frac{1}{2}$ inch metal.

For walks 10 feet wide or less 5 inch columns of $\frac{1}{2}$ inch metal.

For walks 12 feet and over 6 inch columns of $\frac{1}{2}$ inch metal.

Columns over 10 feet in length shall be of $\frac{3}{4}$ inch metal and 1 inch greater in external diameter than the sizes specified above.

All joints in the walk to be made water tight by caulking with oakum and pitch.

Slope: All sidewalks to be so constructed that the top surface shall coincide with the grade of the space between the curb line and the street line, which grade shall be a uniform incline from the street line toward the curb line, with a fall of 1 inch in every 3 feet.

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EXTRACTS FROM VOIDS, SETTLEMENT AND WEIGHT OF CRUSHED STONE.

By IRA O. BAKER, PROFESSOR OF CIVIL ENGINEERING.
University of Illinois Engineering Bulletin No. 23.

THE STONE.

FILE 692.5

The observations referred to in this article relate wholly to limestone, although in the appendix some data are given concerning trap. The limestones experimented with were those quarried at Chester, Joliet and Kankakee.

The Chester stone is a rather coarsely granulated gray limestone of the lower carboniferous group, and is quarried in the grounds of the State Penitentiary at Chester, on the Mississippi River, about half way between St. Louis and Cairo.

The Joliet stone is a compact, fine grained magnesian limestone of the Niagara series, and is quarried in the grounds of the State Penitentiary at Joliet, about 40 miles southwest of Chicago. The output of the crusher consists of 28 per cent 3-in. stone, 53 per cent 2-in., and 17 per cent $\frac{1}{2}$ -in.

The Kankakee stone is a coarse-grained argillaceous lime-stone of the Niagara group, and is quarried at Kankakee, on the Kankakee River, about 55 miles south of Chicago.

DIVISIONS OF THE SUBJECT.

The subject will be considered under the following heads: I. Specific gravity; II. Absorptive power; III. Percentage of voids; IV. Settlement in transit; V. Weight per cubic yard.

I. SPECIFIC GRAVITY.

A knowledge of the specific gravity of a stone is useful in determining the per cent of voids in broken stone; and the easiest way to determine the weight of a cubic unit of solid stone is to find its specific gravity.

$$\text{Specific gravity} = \frac{W_a}{W_a - W_w}$$

in which W_a is the weight of a fragment weighed in air, W_w the weight of the same fragment suspended in water. If the stone is porous to any considerable extent, the weight in water should be determined so quickly that the absorption during the weighing will be inappreciable.

II. ABSORPTIVE POWER.

A knowledge of the amount of water absorbed by a stone is useful in determining the voids by the method of pouring in water, and is also useful in correcting the weight of wet stone.

The absorption was determined by thoroughly drying a specimen, weighing it, immersing it in water for 96 hours, drying with blotting paper, and weighing

III. PERCENTAGE OF VOIDS.

The per cent of voids in broken stone of different sizes has an important bearing upon the amount of cement and sand required in making concrete; and the per cent of voids in connection with the weight of a unit of solid stone is useful in determining the weight of a unit of volume of broken stone.

The percentage of voids may be determined in either of two ways: (1) by pouring in water; and (2) by computation from the specific gravity and the weight of a volume of broken stone.

1. By Pouring in Water. Determine the weight of water a given vessel will contain, then fill the vessel with broken stone, and determine the weight of water that can be poured into the interstices of the broken stone. The ratio of the first amount of water to the second is the proportion of voids.

In this method three sources of error require consideration. (a). In pouring in the water, part of the contained air is not driven out; and therefore the resulting per cent of voids is too small. The error from this source may be reduced, if not entirely eliminated, by pouring the stone into the water; but this procedure introduces a new error, since the stone will not pack to the same degree as in the ordinary method of filling a vessel or bin with broken stone, and hence the result of pouring the stone into the water will also give too large a per cent of voids. (b). If the stone absorbs water during the test the apparent per cent of voids will be too great. (c). If the vessel has a wide

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mouth, as almost necessarily it should have, there will be a likelihood of considerable error in telling when the vessel is exactly full of stone and also of water. The resulting error may make the per cent of voids either too large or too small.

2. By Computation. Determine the weight of a known volume of broken stone. Compute the weight of an equal volume of the solid stone by multiplying the known volume by the weight of an equal volume of water and by the specific gravity of the stone. The difference between the weight of the volume of solid stone and that of the broken stone is the weight of stone equal to the volume of the voids. The ratio of this weight to the weight of the given volume of broken stone is the proportion of voids.

This method is subject to the error of determining when the vessel is exactly full of stone. In practice it is more complicated than the preceding method, but it is more exact.

TABLE 6.
Summary of Per Cent of Voids.

| Ref. No. | Location of Quarry | Size of Stone | Per Cent of Voids | |
|-------------|-----------------------|--|------------------------|-----------------------------|
| | | | By Pouring in Water | From Specific Gravity |
| 1 | Chester | $\frac{3}{8}$ in. Scr. | 40.9 | 46.8 |
| 2 | " | $\frac{3}{4}$ in. Scr. | 43.0 | 45.6 |
| 3 | " | $\frac{2}{3}$ in. to $\frac{3}{4}$ in. | 46.6 | 46.6 |
| 4 | " | 3 in. to 2 in. | 46.1 | 45.1 |
| 5 | Joliet | $\frac{1}{2}$ in. Scr. | 42.2 | 47.1 |
| 6 | " | $\frac{2}{3}$ in. to $\frac{1}{2}$ in. | 47.9 | 46.2 |
| 7 | " | 3 in. to 2 in. | 47.5 | 46.1 |
| 8 | Kankakee | $\frac{3}{8}$ in. Scr. | 39.6 | 46.1 |
| 9 | " | $1\frac{1}{4}$ in. to $\frac{3}{8}$ in. | 45.7 | 44.7 |
| 10 | " | $2\frac{1}{4}$ in. to $\frac{3}{8}$ in. | 44.3 | 42.9 |
| 11 | " | $2\frac{1}{4}$ in. to $1\frac{1}{4}$ in. | 46.2 | 43.4 |

IV. SETTLEMENT OF CRUSHED STONE IN TRANSIT.

Sometimes crushed stone is bought by bulk, in which case it may make a difference whether the volume is measured at the beginning or at the end of the journey. Therefore experiments were made to determine the settlement of crushed stone during transit in wagons and also in railway cars.

TABLE 10.
Summary of Data on Settlement.

| Ref. No. | Location of Quarry | Size of Stone | Settlement after a Haul of | |
|-------------|-----------------------|--|--|--------------------------------|
| | | | $\frac{1}{2}$ mile or more in wagons | 75 miles or more in cars |
| 1 | Chester | $\frac{3}{8}$ in. Scr. | 12.7 | ... |
| 2 | " | $\frac{3}{4}$ in. Scr. | 11.8 | 10.6 |
| 3 | " | $\frac{2}{3}$ in. to $\frac{3}{4}$ in. Scr. | 9.2 | ... |
| 4 | " | 3 in. to 2 in. Scr. | 8.2 | 7.0 |
| 5 | Joliet | $\frac{1}{2}$ in. Scr. | 9.1 | 8.4 |
| 6 | " | $\frac{3}{4}$ in. Scr. | ... | 9.7 |
| 7 | " | $\frac{2}{3}$ in. to $\frac{1}{2}$ in. Scr. | 6.6 | 7.4 |
| 8 | " | $\frac{2}{3}$ in. to $\frac{3}{4}$ in. Scr. | ... | 9.5 |
| 9 | " | 3 in. to 2 in. | ... | 7.8 |
| 10 | Kankakee | $\frac{3}{8}$ in. Scr. | 10.0 | ... |
| 11 | " | $1\frac{1}{4}$ in. to $\frac{3}{8}$ in. Scr. | 8.6 | ... |
| 12 | " | $2\frac{1}{4}$ in. to $\frac{3}{8}$ in. Scr. | ... | 5.4 |

V. WEIGHT PER CUBIC YARD OF CRUSHED LIMESTONE.

Broken stone is usually sold by weight even though the unit is nominally the cubic yard, since it is the custom to determine the number of cubic yards in a shipment by weighing the shipment and dividing the total weight by the supposed weight of a cubic yard. It does not appear that any adequate observations have been made to determine the weight of a unit of volume of the different sizes and kinds of crushed stone.

Tests to determine the weight of a unit of volume of crushed limestone were made on stone from Joliet, Kankakee and Chester, both in wagons and in cars, at the same time the record was taken of the settlement, as previously described.

TABLE 14.
Summary of weights of Crushed Limestone. Result in pounds per cubic yard.

| Ref. No. | Location of Quarry | Size of Stone | Wagon Loads | | Car Loads | |
|-------------|--------------------|---|-------------------|---|-------------------|---|
| | | | Wt. at Crusher | After a Haul of $\frac{1}{2}$ mile or more | Wt. at Crusher | After a Haul of $\frac{75}{8}$ miles or more |
| 1 | Joliet | $\frac{1}{2}$ in. Scr. | 2303 | 2533 | 2659 | 2905 |
| 2 | " | $\frac{3}{4}$ in. Scr. | ----- | ----- | 2652 | 2882 |
| 3 | " | 2 in. to $\frac{1}{2}$ in. | 2315 | 2480 | 2386 | 2592 |
| 4 | " | 2 in. to $\frac{3}{4}$ in. | ----- | ----- | 2296 | 2516 |
| 5 | " | 3 in. to 2 in. | ----- | ----- | 2361 | 2553 |
| 6 | Chester | $\frac{3}{4}$ in. Scr. | 2442 | 2797 | 2546 | 2850 |
| 7 | " | 2 in. to $\frac{3}{4}$ in. | 2344 | 2582 | ----- | ----- |
| 8 | " | 3 in. to 2 in. | 2367 | 2569 | 2348 | 2545 |
| 9 | Kankakee | $\frac{3}{8}$ in. Scr. | 2430 | 2697 | ----- | ----- |
| 10 | " | $1\frac{1}{4}$ in. to $\frac{3}{8}$ in. | 2325 | 2546 | ----- | ----- |
| 11 | " | $2\frac{1}{4}$ in. to $\frac{3}{8}$ in. | ----- | ----- | 2260 | 2390 |

Disregarding whether the stone is measured in a car or a wagon, and also disregarding whether it is measured at the crusher or at its destination, the following summary is obtained.

Mean Coefficient by Which to Multiply the Weight of a Cubic Foot of Solid Limestone to Obtain the Weight of a Cubic Yard of the Crushed Stone.

| | | |
|------------------------------|-------|------|
| $\frac{1}{2}$ in. screenings | ..... | 15.5 |
| 2 in. to $\frac{1}{2}$ inch | ..... | 14.6 |
| 3 in. to 2 inch | ..... | 15.2 |

Average 15.1

Notice that the coefficient is largest for the finest stone, and smallest for the intermediate size. The same is true for trap even though the sizes slightly differ. This seems to prove that the weight of screenings is greater than that of coarser stone, while the weight of the intermediate size is less than that of either extreme size.

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GENERAL.—The contractor for this work will be required to furnish all the material and labor of every description required to erect the same in place complete. The contractor is referred to the plans and details for the general construction, and especially the steel diagrams and details showing connection between the structural steel and tile work.

SPECIAL SHAPES.—The contractor shall furnish all necessary special shapes for the proper fitting to the steel work.

DETAILS.—When requested to do so the contractor shall furnish large scale details or full sized drawings for all special shapes, column coverings, lintel covers, girder covers, and general type of arch, which shall be submitted to the architects for their approval.

SCAFFOLDING, TOOLS, ETC.—Furnish all the tools, machinery, hoisting apparatus and centering necessary to carry on the work at the rate of progress stipulated in the contract.

TILE.—All the tile required for this work shall be of the best quality of hard burned fire clay, semi-porous, or porous terra cotta. This tile to be well manufactured, no badly split, cracked or warped tile will be permitted to go into the work.

MORTAR AND LAYING.—All tile work for the floor construction shall be laid in mortar composed of one (1) part American Portland Cement, of approved brand, four (4) parts sharp sand and one part (1) lime mortar, all thoroughly well mixed together as follows: The sand and cement are to be mixed together dry and sufficient water added to thoroughly wet the same, after which the lime mortar is to be added and the whole mass is then to be thoroughly tempered. All other tile work is to be laid in mortar composed as follows: One (1) part Louisville, Rosendale, or other natural cement, three (3) parts sharp sand and one part lime mortar, thoroughly mixed in the manner before described. All tile must be laid with full flush joints, plumb, to a line, with horizontal beds uniformly level on each course. Fill all the joints, chinks and crevices between the tile and steel work with mortar well slushed in.

TYPE OF ARCH.—The arches for the floors in general shall be —— inch; flat or segment arches, with side or end construction. Skewbacks carefully bedded in place against beams.

BEAM TILE.—The soffits of all beams to be protected with slabs of tile at least 1 inch in thickness. If more than one inch, the beam tile must be made with air space next to beam.

ROOFS.—The arches for the main roof are to be —— in segment or flat arches same as specified for the floors.

MINOR ROOFS.—The roofs of pent houses, roof over projecting portion in second story, floor of bulkheads, and other portions indicated on details as book-tile shall be made of three-inch (3 in.) book-tile set in place between tee-irons. Tee-irons to be furnished by the iron contractor.

PARTITIONS.—All partitions shown on the plans to be built the thickness indicated in figures. If no dimensions are given, the following sizes will govern:

Partitions for all corridors and for partitions over 12 feet and up to 14 feet in height to be 4 inches. Partitions over 14 feet in height to be 6 inches, and all cross partitions 12 feet or less to be 3 inches. Partition walls to be built straight, true, plumb and well bonded with proper "breakjoint" bond on each alternate course, and all joints thoroughly flushed up with mortar, and to be well wedged underneath.

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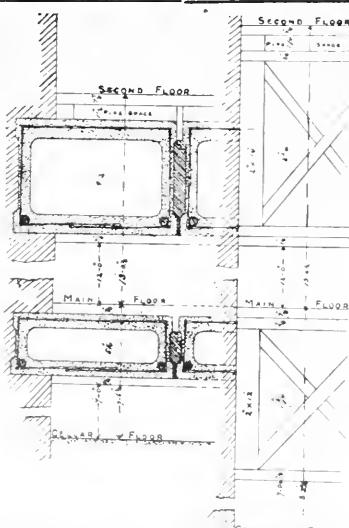
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No. 2 Beams 20 = 140
" 1 " " 16 = 85 " " " "
2 in. x 12 in. at 12 in., " 16 = 90 " " "
Main Floor to Cellar Floor Wood Joists 8 ft. - 2 3/8 in.
" " " " Climax Beams 7 ft. - 6 1/4 in.
" " " " Second " " 13 ft. - 0 1/2 in.
" " " " Wood Joists 13 ft. - 6 1/4 in.

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FURRING TILE.—Where indicated on plans, 2 inch furring tile are to be built against the outside walls of the building. These tiles are to be secured to the brick walls with 10d spikes on every third course, driven into the brickwork at intervals not greater than 48 inches apart.

CURB WALL.—The curb wall in basement shall be furred with three-inch (3 in.) tile extending up to the under side of the iron plate along edge of curb wall and properly fitting around all beams.

ROUGH FRAMES AND BLOCKS.—The contractor for carpenter work will furnish and erect the rough wood frames at all openings in partitions and furring. He will also furnish all wooden blocks necessary to form nailing facilities for attaching plaster grounds, etc. These blocks must be built in place by fireproofing contractor wherever directed by the architect.

COLUMN COVERING.—All column covering shall start, in all cases, directly from the tile arches of floor. Column covering shall be designed to properly fit the columns.

All corners of square columns shall be left square or round. Column covering to be wired on once or twice in each course in height or secured together with clamps.

COVERING EXPOSED STEEL WORK.—All girders, beams, channels, etc., that show below the under side of ceilings are to be encased on all sides with at least 1-inch thickness of fire-proof tile secured to the steel in the usual manner. If required, special designs must be submitted to the architect.

BOXES FOR PLUMBING PIPES.—All soil, vent, down spout and water supply pipes shall be boxed in, using three-inch (3 in.) tile, starting from the floor tile in all cases. This boxing shall not be done until the pipes have been properly tested, and covered by another contractor. There shall be no openings into boxes except for outlets on the various floors. Where these outlets occur small wood frames furnished by carpenter shall be set by the fireproofing contractor.

BULKHEADS.—All bulkheads of first and second floor shall be built of 3-inch tile; the structural iron contractor furnishing all necessary tee-irons for the support of the tile. See details for bulkhead treatment, and iron drawings for the supports.

Provide three-inch (3 in.) tile for the ends of bulkheads where intersected by the entrance doors.

TOILET ROOM FLOORS.—All toilet room floors where shown on plans shall be raised approximately one foot with fireproofing. Supports to be so arranged as not to interfere with the piping of these rooms.

PENT HOUSES.—The contractor shall build the walls of pent houses with four-inch (4 in.) hard or glazed tile, laid up in Portland cement mortar, all joints to be thoroughly flushed up.

Curbs of all skylights shall be built of four-inch tile.

FLOOR STRIPS AND CONCRETE FILLING.—After the floor arches have been set in place, and at such times as may be designated by the architect, the contractor for carpenter's work will furnish and set the 2x3-inch wood floor strips required as nailing ground for the finished wood flooring, where wooden flooring is called for.

After the strips have been set, the fireproofing contractor must fill in between the same with concrete filling; this concrete is to be composed of one (1) part American Portland Cement, of approved brand, two (2) parts sharp sand, and six parts broken tile, stone, gravel or fine, clean coal cinders, thoroughly mixed together dry, then tempered and mixed, and tamped in place. In no case shall cinder concrete be allowed to come in contact with structural steel.

FINALLY.—Do everything necessary to finish the entire work in a thorough and substantial manner. Remove promptly from the premises all the tools, scaffolding, unused tile, debris, etc., as soon as the work is completed.

STRENGTH OF MATERIALS.

STRESSES.

A 'stress' is a force which acts in the interior of a body and resists the external forces which tend to change its shape. Three kinds of simple stress are produced by forces which tend to change the shape of a body.

** highest point of ceiling for height of wall.

OPENINGS.

Openings in plastering to be measured between grounds. No deductions to be made for openings of two feet or less in width. One-half of contents to be deducted for openings two feet or more in width. The contents on all store front openings to be deducted, and the contractor to be allowed one foot six inches for each jamb by the height.

All beams or girders projecting below ceiling line to have one foot in width by total length added for each internal and external angle.

CORNER BEADS, ARCHES, ETC.

All corner angles of more or less than 90 degrees, beads, quirks, rule joints, and moldings, to be measured by the lineal foot on their longest extension, and one foot for each stop or miter.

CORNICES.

Length of cornices to be measured on walls. Plain cornices of two feet girth or less to be measured on walls by the lineal foot. Plain cornices exceeding two feet girth to be measured by the superficial foot. Add one lineal foot to girt for each stop or miter. Enriched cornices (cast work), by the lineal foot for each enrichment.

Arches, corbels, brackets, rings, center pieces, pilasters, columns, capitals, bases, rosettes, bosses, pendants and niches, by the piece. Ceiling or frieze plates over eight inches wide, by the square foot.

COLUMNS.

All columns to be measured by the lineal foot for plain plastered columns.

CEMENT WAINSCOTING.

All cement wainscot to be measured by the square foot, openings to be allowed as for plain plaster.

GROUNDS.

All grounds for various classes of work to be as follows, unless expressly specified to the contrary:

| | |
|--|----------------------|
| work | 5/8 inch |
| Grounds for hard mortar metal lath work, on $\frac{1}{2}$ -inch iron furring | 1 $\frac{1}{2}$ inch |
| Grounds for 2-coat work on brick or tile | 5/8 inch |
| Grounds for hard mortar on brick or tile | 5/8 inch |
| Grounds for hard mortar lath work | 3/4 inch |

Where metal lath is spoken of it applies to all wire or metal lath.

In accordance with agreements between the International Operative Plasterers' Union and the American Brotherhood of Cement Finishers, it is agreed that Plasterers shall claim and do all exterior and interior plastering, whether of stucco, cement or any patent material, when done in and by the usual methods of plastering, including the covering of all walls, ceilings, soffits, piers, columns, or any part of a construction of any sort, when any part of a construction is covered with any plastic material in the usual methods of plastering.

In accordance with agreements between the International Operative Plasterers' Union and the Ceramic, Mosaic and Encaustic Tile Layers and Helpers' International Union, it is agreed that all walls and ceilings upon which a foundation or base coat is put on by the plasterers, ample room shall be allowed for a final coat of not less than three-eighths of an inch, to be put on by the tile layers, to act as a binder and regulator for the float coat upon which the tile is placed.

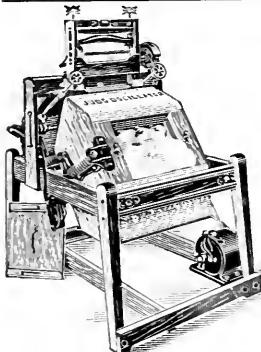
It is also agreed that the plasterers shall use only sand and cement in the preparations of walls for the work as above stipulated.

It is also agreed that this shall not interfere with the right of the tile layers to do the scratch coating on all small jobs of one or two ordinary sized bath rooms. No scratch coating shall be put on except by mechanics of either trade.

Patching of plastering after other mechanics shall not be done as a part of the contract price.

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STRENGTH OF MATERIALS.

STRESSES.

A 'stress' is a force which acts in the interior of a body and resists the external forces which tend to change its shape. Three kinds of simple stress are produced by forces which tend to change the shape of a body.

They are: Tensile, tending to pull apart, as in a rope; compressive, tending to push together, as in a column; shearing, tending to cut across, as in punching a plate.

The **ultimate strength** of a material under tension, compression, or shear, is the greatest unit-stress to which it can be subjected. This occurs at or shortly before rupture, and its value is very different for different materials; thus if a bar whose cross-section is A breaks under a tensile stress, P , the ultimate tensile strength of the material is $P \div A$.

When a small stress is applied to a body a small deformation is produced, and on the removal of the stress the body springs back to its original form. For small stress material, then may be regarded as perfectly elastic.

Under smaller stresses the deformations are approximately proportional to the forces, or stresses, which produce them, and also approximately proportional to the length of the bar or body.

When the stress is great enough a deformation is produced which is partly permanent, that is, the body does not spring back entirely to its original form on removal of the stress. This permanent part is termed a set. In such cases the deformations are not proportional to the stresses.

When the stress is greater still the deformation rapidly increases and the body finally ruptures.

A sudden stress, or shock, is more injurious than a steady stress or than a stress gradually applied.

The **elastic limit** is that unit-stress at which the permanent set is first visible and within which the stress is directly proportional to the deformation. For stresses less than the elastic limit bodies are perfectly elastic, resuming their original form on removal of the stress.

The **working strength** of a material is that unit-stress to which it is, or is to be, subjected. For safety, this must not be greater than the elastic limit of the material used. It should be considerably less to allow for possible defects, usually taken at from one-third to two-thirds the average elastic limit.

Factor of safety for a body under stress or for a piece to be designed is the ratio of the ultimate strength to the working, or the proper allowable working, strength.

Fundamental principles of engineering design are stability and economy: First, the structure must safely withstand all the stresses which are to be applied to it; second, the structure must be built and maintained at the lowest possible cost.

The second of these fundamental principles requires that all parts of the structure should be of equal strength in proportion to the loads which they are required to carry.

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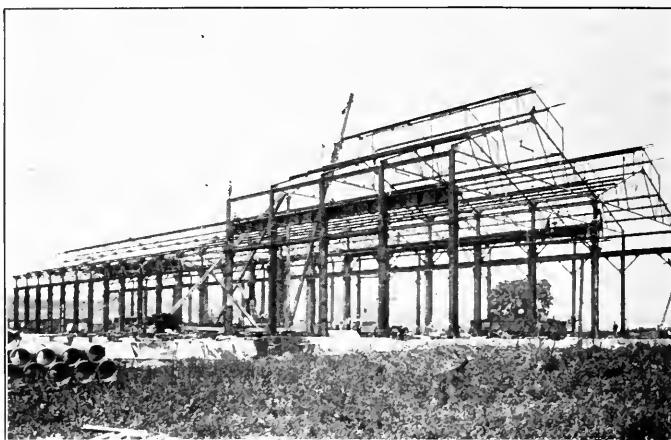
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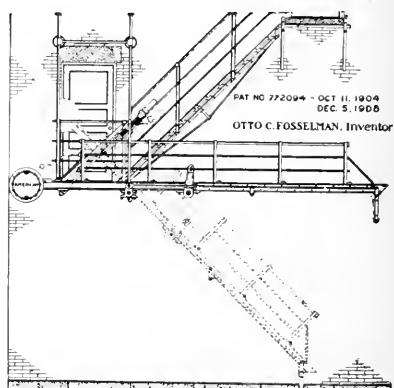
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BASE AND BEARING PLATES FOR COLUMNS AND BEAMS.

A. Plain Plates Without Ribs.

By N. Clifford Ricker, D. Arch., Professor of Architecture.

Abstract from a Bulletin to be published by the Engineering Experiment Station of the University of Illinois.

1. EXPLANATIONS—Since both experiments and theory have proved that cast iron base plates break along a diameter, and not along a line tangent to the lower end of the column, it became necessary to deduce a new series of formulas and to devise simple methods and tables for applying these formulas in practice. The formulas previously given are safe under ordinary conditions, but those here given will be found applicable in all cases, and more easily and rapidly. They may also be employed to fulfill the requirements of any building ordinance.

2. LIMIT OF SAFE PRESSURE OF PLATE ON MASONRY

This varies greatly with the material and according to the ordinances of the different cities, varying between 70 and 1000 lbs. per sq. inch. The proper value must be taken as prescribed by the local building law. The maximum safe pressures permitted in Chicago are as follows, in lbs. per sq. inch:

| | |
|-----------------------------------|--------|
| Portland cement concrete..... | 173.61 |
| Dressed dimension stone..... | 173.61 |
| Rough dimension stone..... | 138.89 |
| Brickwork in Portland cement..... | 173.61 |
| Brickwork in ordinary cement..... | 125.00 |
| Brickwork in lime mortar..... | 90.28 |

3. MAXIMUM SAFE FIBRE STRESS IN PLATE

The following values for fibre stresses in lbs. per sq. inch are generally adopted:

Steel, 16,000 for tension or compression.

Wrought iron, 12,000 for tension or compression.

Cast iron, 2,500 or 3,000 for tension.

Cast iron, 10,000 or 16,000 for compression.

Experiments on plates prove that 3,000 is safe for tension in cast iron, if the plates are properly inspected.

4. NOTATION EMPLOYED IN FORMULAS—The fracture line is here assumed to be the shortest diameter of the plate, and the moments of the upward and downward pressures acting on one-half the plate are taken about this fracture line or diameter.

Let A = bottom area of plate in sq. inches.

B = length in inches of fracture line.

c = vertical distance in inches from horizontal neutral axis of fracture section to bottom of plate.

f = maximum safe tensile fibre stress in lbs. per sq. inch acting in metal of plate at fracture section.

K = length in inches of horizontal top of fracture section beneath end of column or of beam.

nK = projection in inches of fracture section outside end of column or beam.

I = moment of inertia of vertical fracture section of plate.

$\frac{I}{c}$ = modulus of resistance of fracture section.

L' = lever arm in inches of moment about fracture line, for the upward pressure of masonry on one-half area of plate.

L'' = lever arm in inches of moment about fracture line, for the downward pressure of column or beam end on one-half area of plate.

M = resultant bending moment in inch-lbs. about fracture line, for one-half area of plate.

R = maximum safe resisting moment in inch-lbs. for fracture section of plate.

p = maximum safe pressure of plate on masonry in lbs. per sq. inch. For values, see Art. 2.

$P = A p$ = total weight in lbs. of plate and its load. Since the weight of plate is very small in comparison with its load, it may usually be omitted without serious error.

t = thickness in inches of plate beneath end of column or beam.

t' = thickness in inches at edge of tapered plate.

5. GENERAL FORMULAS— $M = \frac{P}{2}(L' - L'')$ is the general formula, which is applicable in all cases.

$R = \frac{f B t^2}{6}$ applies to plates of uniform thickness. Equating and reducing these formulas, we obtain the following general formula for plates of uniform thickness only:

$$t = \sqrt{\frac{3P}{B}(L' - L'')}$$

This formula can also be used for obtaining the thickness of a wall or bearing plate, which is tapered in thickness toward each end.

The formulas for the thickness of tapered cast iron plates under columns are very complicated in form and tedious in application, so that they are here omitted. But a method of obtaining the thickness in this case is given in Art. 7.

6. FORMULAS FOR VALUES L' AND L'' .

$L' = \frac{\text{length in ins.}}{4}$, for wall or bearing plate.

$L' = \frac{\text{side in ins.}}{4}$, for square plate.

$L' = \frac{\text{inscribed diameter in ins.}}{4.58}$, for octagonal plate.

$L' = \frac{\text{diameter in ins.}}{4.74}$, for round plate.

$L'' = \frac{\text{width of beam in ins.}}{4}$, for wall or bearing plate.

$L'' = \frac{\text{side in ins.}}{4}$, for solid square post.

$L'' = \frac{\text{inscribed diameter in ins.}}{4.58}$, for solid octagonal post.

$L'' = \frac{\text{diameter in ins.}}{4.74}$, for solid cylindrical post.

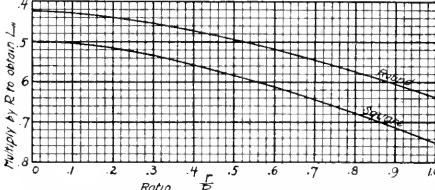
$L'' = .500 \frac{R^3 - r^3}{R^2 - r^2}$, for hollow square column.

$L'' = .424 \frac{R^3 - r^3}{R^2 - r^2}$, for hollow round column.

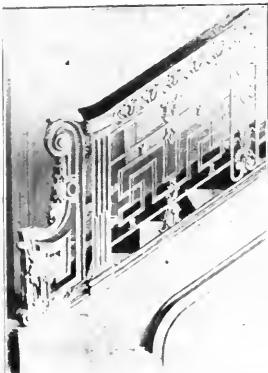
In the last two formulas only:
 R = external half side in ins. of square column or radius of round column.

r = internal half side in ins. of square column or radius of round column.

Table for L'' for Column Section, Fig. 3.



The required values of L'' for hollow columns may be easily obtained by the aid of the table in Fig. 3.



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Example.—Required L'' for column 12 in. square and with $1\frac{1}{2}$ in. metal. Then $\frac{r}{R} = \frac{4.5}{6.0} = 0.67$. Taking vertical through 0.67 in. Fig. 3, its intersection with the line for square column

gives 0.635 at left side by a horizontal. Then $L'' = 0.635 \times 6.00 = 3.81$ ins.

7. GRAPHICAL TABLES.

Calculations for base plates may be almost entirely avoided by using the following graphical tables:

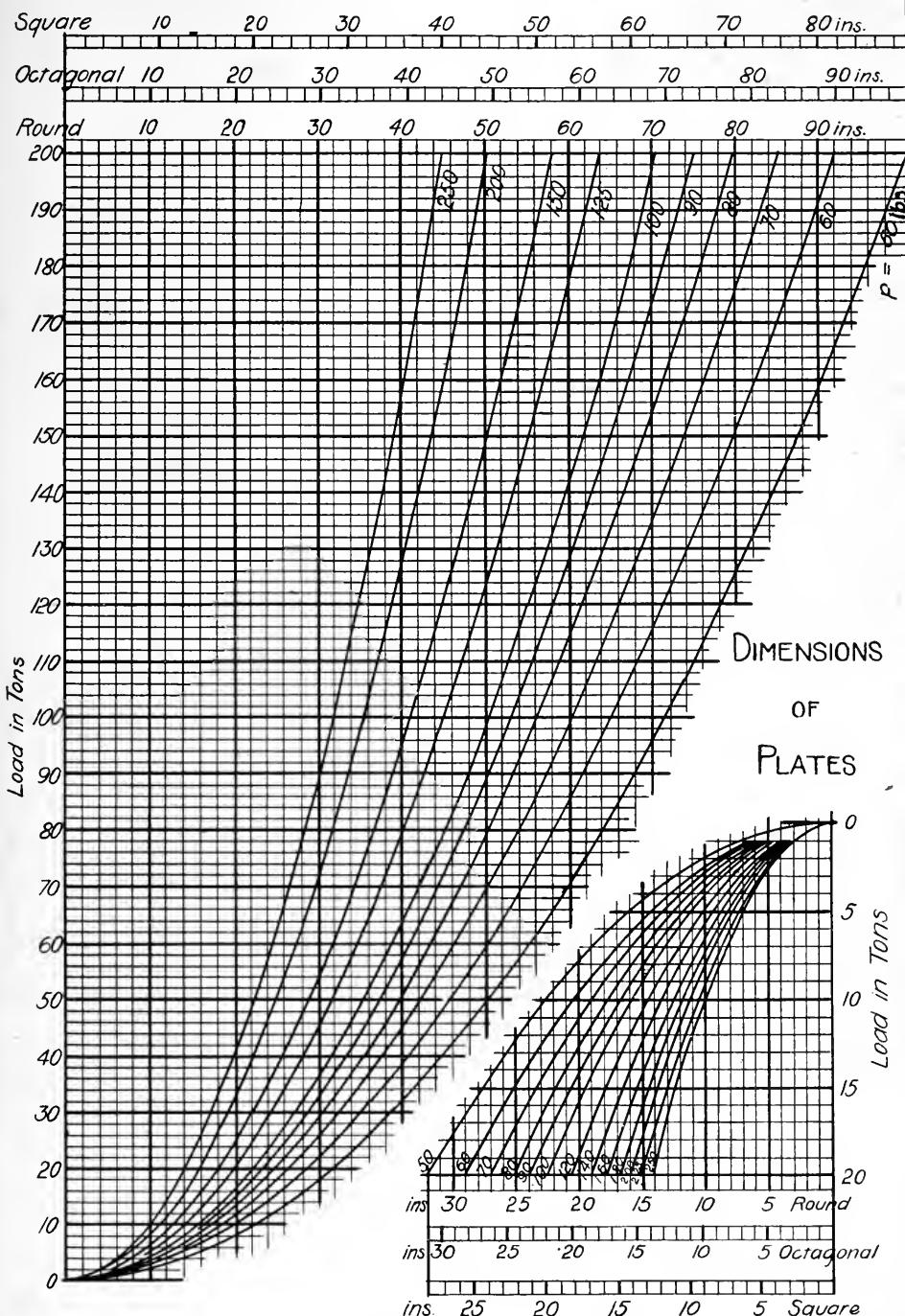


Fig. 4

Fig. 5.2

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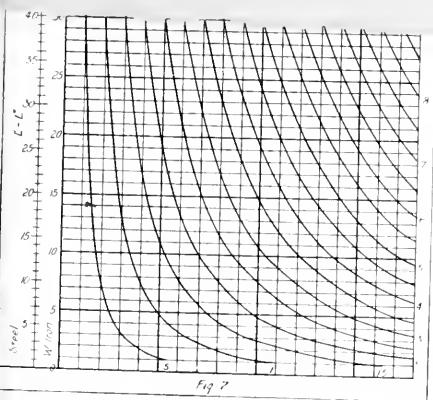
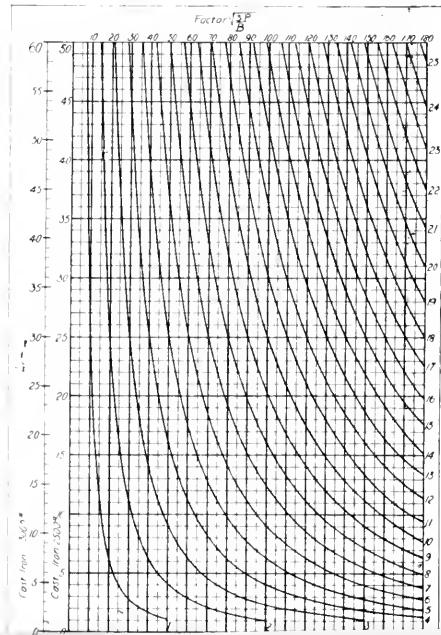
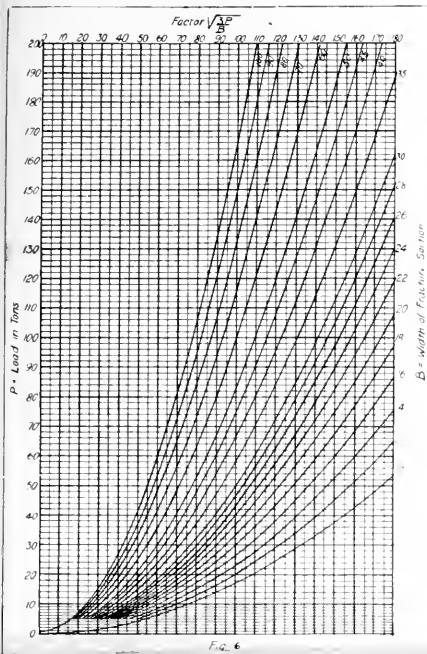
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Figs. 4 and 5 give directly the side of a square, the inscribed diameter of an octagon, or the diameter of a round plate, for loads not exceeding 200 tons.

Fig. 7 then determines the required thickness of a steel or wrought iron plate of uniform thickness.



the factor $\sqrt{\frac{B}{P}}$. By Art. 6, $L' = 9.75$. By

Fig. 3 in Art. 6, $L'' = 2.53$. Hence $L' - L'' = 9.75 - 2.53 = 7.23$ ins. In Fig. 7, a horizontal through 7.23 on line for steel at left side intersects vertical through 118 at top of plate on the curve for 2.5 ins., the required thickness of the steel plate.

Example 2.—Required, the thickness of a square cast iron plate under the same conditions. Safe fibre stress 2500 lbs., the edge thickness to be one-fourth its thickness beneath the column.

In Fig. 8, a horizontal through line for 2500 lbs. at the left intersects a vertical through

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118 at top on a curve corresponding to $6\frac{3}{8}$ ins.
 t = uniform thickness of plate. But $\frac{t}{t} =$

$$0.25. \quad n = \frac{39 - 9}{2 \times 9} = 1.67.$$

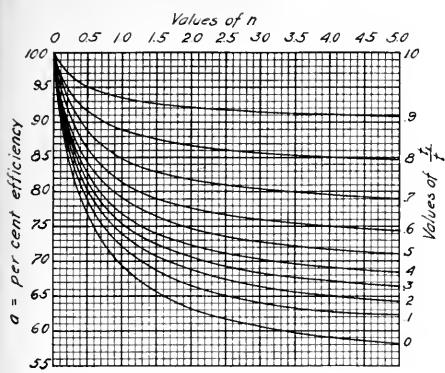


Fig. 9.

In Fig. 9, a vertical through 1.67 at top intersects curve for 0.25 on a horizontal through 71 per cent at left side. This means that such a tapered plate would have 71 per cent of the resistance of a plate of uniform thickness, t .

Let a = this per cent found by Fig. 9.

Then $t \times \sqrt{\frac{100}{a}}$ = required increased thickness beneath the column possessing the required strength.

And $6.375 \times \sqrt{\frac{100}{71}} = 7.57$ ins. = required thickness

beneath the column. Also $\frac{7.57}{4} = 1.89$, say $1\frac{7}{8}$ ins. thick at edge and $7\frac{1}{16}$ ins. at centre of plate.

B Plates with Vertical Ribs.

By C. E. Noerenberg, Arch. Eng.

(Research Fellow in Architecture.)

Abstract of a Bulletin to be issued by the Engineering Experiment Station of the University of Illinois.

Exact information concerning this detail of construction is very limited in amount, and therefore such plates are generally designed by mere "rules of thumb." The writer has made the only known series of tests on actual plates, and from the results are deduced the following conclusions and formulas:

The first series of tests was made on thirty plates, comprising the types of square, octagonal and round plates, with four or eight ribs each variously arranged. They were designed in accordance with Clausen's theory as stated in the Handbook for 1908. They were cast in a local foundry, then tested to destruction on an elastic cushion reproducing practical conditions as closely as possible. But the fact that the ultimate strengths of the plates were not uniform, varying from 566,000 pounds to 330,000 pounds, that the

actual modulus of rupture per sq. in. varied from 69,500 pounds (an impossible value for cast iron) to 41,560 pounds, and that the plates did not break in the manner assumed, proved the theory defective. Hence the following theory and formulas were employed in designing a second series of plates.

According to all the former tests, the plate breaks through its centre on a line, which is the least diameter of the plate, that one possessing the least resistance to bending. For the plate acts as an inverted double cantilever beam, loaded by the reaction of the foundation—equal to the load on the plate—and supported at its centre by the column. Observations proved that for the ribbed plate, even under the ultimate load, the outer edges of the plate deflect very slightly, and therefore that the pressure is fairly uniform over the entire surface. Then, since this least diameter defines the weakest part of the plate, the strength of this "fracture section" determines the actual strength of the plate. The uniform pressure on the bottom of the plate per sq. in. of area exerts a bending moment, which must be resisted by the resistance moment of the fracture section.

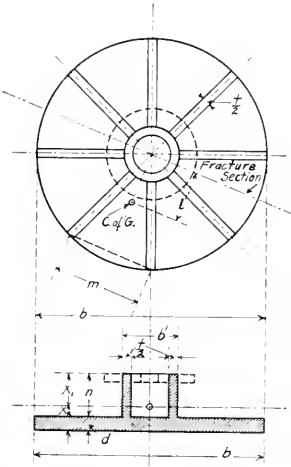


Fig. 10.

Assume a circular plate, for example, as in Fig. 10, with a central hollow cylindrical hub and eight equidistant ribs. The horizontal projecting parts of the top flange, to which the column is bolted, are omitted in the theoretical design, since such parts have such varied dimensions and small actual strength, and since their omission is on the safe side. The metal of the hub is usually placed directly beneath the metal in the column section, and the metal areas in both are equal. The thickness of the metal in the hub and ribs, for practical reasons and for economy of design, as determined by the writer in an extended investigation, should be taken at one-half the thickness of the bottom plate. Then the height and thickness of hub and ribs, and the

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thickness of bottom plate, are the only elements affecting the strength of the plate, the horizontal section and diameter of the hub being immaterial.

Let A = bottom area of plate in sq. ins. = area necessary to support the column and load.

P = total load on the plate in lbs.

p = maximum safe pressure of plate on masonry in lbs. per sq. inch.

l = lever arm in ins. of moment about fracture line = distance from centre of gravity of one-half the area of plate from the fracture diameter of plate.

m = greatest distance in ins. between centre lines of two adjacent ribs.

M = bending moment in inch-lbs. about fracture line for one-half the area of plate.

t = thickness in inches of metal in hub and ribs.

S = safe tensile fibre stress in lbs. per sq. inch for metal of plate.

Let the plate have the dimensions shown in Fig. 10.

Then evidently $A = \frac{P}{p}$.

The bottom plate between the ribs acts as a beam fixed at its ends, and the required thickness at the outer edge of the plate depends on the greatest distance between centres of two adjacent ribs.

$$\text{Or } d = m \sqrt{\frac{P}{2S}}.$$

If t be made equal to d as already explained, the only other required dimension is the height of the plate, and this is determined by means of the breaking moment,

$$M = \frac{A \cdot p \cdot l}{2}$$

This must equal the resisting moment of the fracture section, or $= R$, hence—

$$M = R = \frac{S I}{e}$$

$$\text{Therefore } \frac{I}{e} = \frac{A \cdot p \cdot l}{2S}$$

The required value of $\frac{I}{e}$ for this T-shaped section is obtained by the usual formula.

$$\frac{I}{e} = \frac{t x^3 + b x'{}^3 - (b - t)(x - d)^3}{3 x'}$$

$$\text{Wherein } x = \frac{(h + d)^2 t + (b - t) d^2}{2(b + h)t}$$

$$\text{And } x' = (h + d) - x$$

The first set of plates tested were designed in accordance with this theory, and their modulus of rupture was found to be very uniform for all the types of plates and of nearly the same value for both plates with four and with eight ribs, the average of all being 25,820 lbs. per sq. inch.

A second series of twenty-seven plates of different sizes and of a little better grade of cast iron were tested in the same manner, and the modulus of rupture of the plates with eight ribs was 38,500 lbs. per sq. inch, very little different from that of the plates

with four ribs, which was 38,100 lbs. per sq. inch. Four standard test pieces were cast at the same time and fixed the ultimate resistance of the metal to rupture at 41,335 lbs. per sq. inch, thus proving the correctness of the theory with remarkable accuracy.

The tests prove that the square plate is most variable in strength, and that the circular plate is most consistent and that it is to be preferred to the other types. The plate with eight ribs is far more economical than that with four ribs in the weight of metal required.

For the best economy and proportions, the thickness of metal in the hub and ribs should be one-half the thickness of the bottom plate.

For the value of 173.6 lbs. per sq. inch as the safe maximum pressure of the plate on its foundation, and for 2500 lbs. per sq. inch as the safe maximum fibre stress in the metal (cast iron), as required by the Chicago ordinance, the preceding formulas reduce to the simpler forms:—

$$A = \frac{P}{173.6}$$

$$d = 0.1863 \text{ m.}$$

$$I = \frac{P l}{c}$$

$$c = 5000$$

And when $t = d$:

$$I = \frac{d x^3 + b x'{}^3 - (b - d)(x - d)^3}{3 x}$$

Here:—

$$x = \frac{(h + d) - x}{(h + d)^2 t + (b - d) d}$$

$$x = \frac{2(b + h)t}{2(b + h)}$$

To obtain the value of h , select one value and determine the corresponding value of $\frac{I}{c}$.

If it equals or slightly exceeds $\frac{P l}{5000}$, this value of h may safely be used. If too small, another trial is to be made.

In order to present some values for guidance and comparison, the following table of dimensions for circular plates with eight ribs, as shown in Fig. 10, is here included for various loads:

Table for Circular Base Plates with 8 Ribs.

| Load P. lbs. | Area A sq. ins. | Diam. b. ins. | Thickness d. Hgt. h. | |
|-----------------|--------------------|------------------|----------------------|-------|
| | | | ins. | ins. |
| 20,000 | 115 | 12.4 | 0.86 | 2.63 |
| 35,000 | 201 | 16.0 | 1.14 | 3.48 |
| 50,000 | 288 | 19.1 | 1.37 | 4.16 |
| 75,000 | 432 | 23.5 | 1.67 | 5.09 |
| 100,000 | 576 | 27.1 | 1.93 | 5.88 |
| 125,000 | 720 | 30.3 | 2.16 | 6.57 |
| 150,000 | 864 | 33.2 | 2.37 | 7.20 |
| 175,000 | 1008 | 35.8 | 2.55 | 7.77 |
| 200,000 | 1152 | 38.3 | 2.73 | 8.31 |
| 225,000 | 1296 | 40.6 | 2.90 | 8.81 |
| 250,000 | 1440 | 42.8 | 3.05 | 9.24 |
| 300,000 | 1728 | 46.9 | 3.34 | 10.17 |
| 350,000 | 2016 | 50.7 | 3.61 | 11.00 |
| 400,000 | 2304 | 54.2 | 3.86 | 11.74 |
| 450,000 | 2592 | 57.5 | 4.10 | 12.46 |
| 500,000 | 2880 | 60.6 | 4.32 | 13.12 |

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ROOFING AND ROOFING MATERIAL

Extracts from a paper read before the Chicago Architects' Business Association.

By

L. P. Sibley, Sec.-Treas. National Assn. Master Composition Roofers of U. S. A.

The roofing business is a large one, for it is estimated that, aside from roofs covered with shingles, it costs the property owners of this country \$40,000,000 per year for roofing. A conservative estimate is that gravel or, as they are often referred to, composition roofs, cover more than 60 per cent of the roofing area of the first class buildings and manufacturing plants of this country.

A majority of the specifications for roofing and waterproofing now call for a felt weighing not less than 14 pounds per 100 sq. ft.; records show that more felt is saturated and sold for these purposes weighing less than 12 lbs. per 100 sq. ft. than of the required weight.

A considerable part of the sharp practice and careless workmanship has occurred because of lack of definite specifications to hold a contractor to.

This Association has adopted a specification which we hope will be of assistance in standardizing the business.

The National Association of Master Composition Roofers' specification for use over boards provides for one (1) ply of dry sheathing, five (5) plies of 14-lb. felt, not less than 120 lbs. of pitch, and not less than 400 lbs. of gravel. We recommend the specification for inclines not exceeding 3 inches to the foot.

Before explaining our reasons for deciding on these quantities, I wish to describe the four general methods of laying gravel roofs, as by doing so I can better indicate the value of our specification.

The method most common in this vicinity is to lay the felt shingle fashion one-fifth to the weather and mop each ply just before the succeeding ply is dropped in place. This work is usually done in sections from 40 to 50 ft. in length, depending upon the weather conditions and expertness of workmen.

A second way of applying the felt is to lay it dry, one-fifth to the weather, nailing the upper edges of each ply and then turning the sheets back and mopping underneath.

A third method is to roll the felt out into a hot mopping; in other words, mop with hot pitch just in front of the roll as the felt is being rolled out into place.

A fourth method is to do all the mopping in the open, beginning by laying two plies, nailing the lower edges and mopping the entire surface before any additional felt is laid; then follow with a ply of felt and complete mopping of pitch, and so on until the required number of plies have been laid.

In considering these methods and which is the best, there is a cardinal principle that I wish every architect and inspector could have constantly in mind when considering the roofing question, and that is that a mopping of pitch which covers only one-half or three-fourths or nine-tenths of the roof surface is very little better than no mopping at all as far as preventing the first leak is concerned. The incomplete moppings in a roof will, of course, add to the life of the roof as a whole but, theoretically at least, and in practice

generally, if 100 sq. ft. of roofing has 90 sq. ft. with a mopping of pitch between the plies, and 10 sq. ft. in which there is no pitch between the top ply and the bottom the roof will leak as quickly as if mopping had been omitted entirely.

With this in mind, let us consider the four methods of applying felt. With the first method, the workmen will have a bucket of pitch in the centre of the run of 40 to 60 ft., and will mop from the centre each way on each sheet of felt. At the centre where the mop first strikes the felt, there will be sufficient pitch, and a surplus of it, but a bulk of the pitch on the mop is left on the first 10 to 15 feet of felt, and the last 10 or 15 feet is comparatively dry.

If the mop is a large one, the maximum width of the mopping on each ply may be 16 inches, but is usually less, and as the mop wears smaller the mopping gets narrower, and naturally many small mops are used. If the mopping is only 10 inches wide a workman must be very expert, even when trying his best, not to have some spots without any pitch between the top ply and the bottom.

Also, with this method each ply of felt is cut at the same point and joints are necessary at the end of each run. These joints can be made as strong as any other part of the roof, but should be at least 6 inches wide and have a cap sheet their entire length. There is no question but that a good roof can be laid in this manner, but there is always the danger that there will be many spots in every square where there is no pitch between the top ply and the bottom.

The second method of applying felt is subject to the same criticisms as the first as far as the uneven distribution of the pitch is concerned, but it has one slight advantage in that the whole roof may be covered without each ply of felt being cut through at any one place.

The third method of rolling felt out into a hot mopping will usually insure a more uniform distribution of the pitch than either the first or second method, but it does not insure the felt being laid smoothly without wrinkles, a feature that is of importance. It is also very difficult as this work is usually done to prevent one roll from rolling up hill and the next one down, which results in spots with one less ply of felt than is specified.

The fourth method of laying one ply at a time over the entire roof and mopping the entire surface before laying an additional ply is without question the best one in many respects. Mopping in the open is a very simple matter, and with the most careless workman there is hardly a chance of a spot being left unmopped, and each mopping is necessarily left exposed long enough for any one interested to see that it has been properly done.

To explain our specification in detail, it provides first for one thickness of dry sheathing. The principal purpose for which it is used is to prevent any part of the roof sticking to the boards. Some of you may not think that felt will stick to boards, and if it were alone there would be no trouble, but felt is made so it will absorb hot pitch.

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or tar, and with a mop full of hot pitch on even two thicknesses of felt, the pitch may heat up the tar in the felt sufficiently so it will stick to the boards or perhaps the hot pitch will penetrate the felt to that extent. If the sticking should occur over a joint and the joint open from seasoning, it will tear or at least strain the felt.

Experience indicates clearly that two plies of felt are sufficient to carry a mopping of pitch; therefore, we specify that two plies of felt be laid and surface mopped before any additional felt is laid.

By requiring this we are insured of a complete and perfect mopping of pitch over the entire surface of the roof, and this as far down in the roof as is practicable. Any failure of moppings between the upper plies will be less serious because of the perfect one over the second ply. This method also has the advantage of making it possible to cover in and make water-tight large areas in a very short time.

We follow this with the three plies of felt with pitch between the plies so that "felt shall not touch felt." These three plies may be laid as is the roofers' usual practice, providing of course that there is pitch between them so "felt will not touch felt."

If in laying a five-ply roof the five plies are laid all at one time, as is the more usual practice here, and each lap is mopped back 22 inches, the result will be in every respect as good as if our specification is followed, but it is hard to get this properly done.

As to nailing, we specify by saying "such nailing as is necessary shall be done so that all nails will be covered by at least two plies of felt"—"such as is necessary." The only need of nails is to keep the roof from blowing off, and any roofer will use enough for that as it is far more likely to happen when the work is being done than after the gravel is on.

If the roofer prefers to stick the first two plies together and omit nails entirely, there is no objection to his doing so.

We next come to the surface coating of pitch and gravel. There are two ways of applying this pitch—one with a mop and the other by pouring from a dipper. Personally, I prefer the dipper, for 50 pounds to 60 pounds of pitch will be required to flow over 100 sq. ft. if it is poured, while a mop will spread 30 pounds or less over the same surface.

The gravel should be dry when used and free from material under $\frac{1}{4}$ -inch in size. From $\frac{1}{4}$ to $\frac{5}{8}$ -inch is the best size for flatter surfaces.

Generally speaking, the finer the gravel the less pitch will be required to properly imbed it, and if gravel composed mostly of material from $\frac{1}{8}$ to $\frac{3}{8}$ -inch is being used, you may be sure less pitch will be required for the roof to "pass muster" with the inspector, than if quite a proportion of the gravel is from $\frac{1}{2}$ -inch to $\frac{5}{8}$ -inch.

The amount of pitch required to do equally good work will vary somewhat under different conditions, and we therefore could not be as exact in specifying it as with felt, and have said not less than 120 pounds. It is generally conceded that at least 20 pounds of pitch are required to properly mop 100 sq. ft. of felt under favorable conditions. As we specify three moppings, one each between the second and third, third and fourth, and fourth and fifth plies, this will not leave more than 60 pounds for the surface, and it should not have any less than 60 pounds.

In laying a gravel roof the contractor's cost on three items—the number of plies of felt of given weight and quality, the gravel, and labor of applying these two, is practically a fixed cost. The only chance he has of saving or of increasing his profit is on the amount of pitch used and the labor of applying, and

right here is the "meat in the cocoanut." It is pitch that gives life to the felt and to the roof. Felt is of comparatively little value on a roof unless there is pitch with it.

Now, I want you to consider how little the contractor saves and to what extent he has lowered the value of the roof by reducing the amount of pitch from 120 to, say, 80 pounds, as is frequently done. With the price of pitch in this market, the 40 pounds saved would cost less than 30 cents and the labor for applying it could not exceed another 30 cents, so at the outside the roofer has saved less than $\frac{3}{4}$ cent per sq. ft., but he has without doubt cut the value of the roof more than one-half.

My suggestion is that, if you adopt our specification, you reserve the right to cut into the roof at any point before the gravel is applied, and if felt touches felt where pitch is specified, require that the entire surface of the roof shall be covered with an additional mopping of pitch and ply of felt, or two or three, as the inspection indicates is necessary to make the roof as good as is specified.

Felt and pitch have their limitations, and there cannot be enough pitch used on any surface that approaches perpendicular, so the result can be in any way permanent.

I understand that zinc will not last in this vicinity, and, of course, tin can hardly be considered, and I presume galvanized iron has been tried and found wanting. This leaves only copper and lead of the metals, and, on buildings of a permanent character, that is warranted.

The roof we are asking you to specify is certainly good enough to warrant copper or lead flashings with it. I realize, however, that there are many buildings that do not warrant the use of copper flashings, and where they are not practical felt flashings are necessary to a considerable extent. What can we do to improve them?

In the first place, if lath are used to fasten the felt along the edges or against fire or party walls, soft wood lath only should be permitted.

Second, in flashing against fire or party walls the greatest care should be taken to have the felt fit snugly into the corners, and to have all plies stuck solidly together from that point to the top of the flashing.

Third, the shorter the distance the flashing extends up the wall, the better. If furring strips are built in, they should be not more than 7 inches above the roof. This leaves the least possible amount of felt exposed and there is less opportunity for the pitch to settle from between the plies.

The creosoting of the wooden laths or treating them with some other wood preservative is sometimes required, but as a rule wooden laths will last as long as will the pitch and felt that is used with them. The pitch and felt used in the roof proper, of course, lasts much longer, for it is protected by the gravel.

Edges of a roof that are exposed, or where the water drips off, should in every case be protected by a metal gravel stop. The use of a wooden cleat for this purpose is, in my opinion, very poor economy, for with it there can be no protection to the edges or ends of the roof boards. With a metal gravel stop the perpendicular part of it extends down $\frac{1}{2}$ inch below the under side of the roof boards, and in this way gives protection that is very necessary.

By turning the felt down over the edge and nailing it, there is a corner on which pitch will not remain in any quantity, and which soon cracks, letting water reach the edges of the boards. This water does not get inside of the building, and, therefore, is not a source of trouble at the time, but it rots the ends of the roof boards and makes repair work very expensive.

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| $\frac{3}{8}$ inch | 20 feet | 2 openings | $1\frac{1}{2}$ inch | 150 feet | 60 openings |
| $\frac{1}{2}$ inch | 30 feet | 3 openings | $2\frac{1}{2}$ inch | 200 feet | 100 openings |
| $\frac{3}{4}$ inch | 60 feet | 10 openings | $2\frac{1}{2}$ inch | 200 feet | 200 openings |
| 1 inch | 70 feet | 15 openings | 3 inch | 300 feet | 300 openings |
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For stores the running line to be full size to end of last opening.

All drops to be $\frac{1}{2}$ inch with set not less than 4 inches.

Twenty feet of $\frac{3}{8}$ -inch pipe allowed only for bracket lights.

Window lights to be $\frac{1}{2}$ inch.

Drops in churches, schools, public halls, stores, double parlors, large rooms and halls of office buildings, etc., should be not less than $\frac{1}{2}$ inch for each 168 square feet of floor space.

BUILDING SERVICES.

In running service pipe from front wall to meters the following rules will apply:

| Size of Opening. | Greatest Length Allowed. | Greatest Number of $\frac{3}{4}$ " Openings Allowed. | Size of Opening. | Greatest Length Allowed. | Greatest Number of 1" Openings Allowed. |
|----------------------|--------------------------|--|----------------------|--------------------------|---|
| 1 inch | 70 feet | 1 opening | 1 $\frac{1}{2}$ inch | 150 feet | 5 openings |
| 1 $\frac{1}{4}$ inch | 100 feet | 3 openings | 2 inch | 200 feet | 8 openings |

All openings in service must be equal to the size of riser, which in no case must be less than 1 inch.

MANUFACTURED GAS FOR FUEL.

| Size of Pipe. | Greatest Length Allowed. | Greatest Number of $\frac{3}{4}$ " Openings Allowed. | Size of Pipe. | Greatest Length Allowed. | Greatest Number of $\frac{3}{4}$ " Openings Allowed. |
|----------------------|--------------------------|--|----------------------|--------------------------|--|
| $\frac{3}{4}$ inch | 50 feet | 1 $\frac{3}{4}$ -in. or 2 $\frac{1}{2}$ -in. | 1 $\frac{1}{2}$ inch | 150 feet | 7 or 4 $\frac{3}{4}$ -in. and 6 $\frac{1}{2}$ -in. |
| 1 inch | 70 feet | 2 or 1 $\frac{3}{4}$ -in. and 2 $\frac{1}{2}$ -in. | 2 inch | 200 feet | 15 or 8 $\frac{3}{4}$ -in. and 14 $\frac{1}{2}$ -in. |
| 1 $\frac{1}{4}$ inch | 100 feet | 4 or 2 $\frac{3}{4}$ -in. and 4 $\frac{1}{2}$ -in. | | | |

For mantels, grates and small heating appliances, for heating space not to exceed 1,728 cubic feet, thirty feet of $\frac{1}{2}$ -inch pipe is allowed for one opening only, and two such openings are considered as one $\frac{3}{4}$ -inch opening.

RESIDENCE OR FLAT OF 12 ROOMS OR UNDER. RESIDENCE OR FLAT OF 13 ROOMS OR OVER.

Kitchen opening—not less than $\frac{3}{4}$ inch.

Laundry opening—not less than $\frac{1}{2}$ inch.

Fire-place opening—not less than $\frac{1}{2}$ inch.

All Ruud, Monarch, and Humphrey water heaters, and other heaters of this type, should be provided with separate runs as provided in the following table:

| Humphrey | Monarch | Pittsburg | Ruud | Size of Pipe. |
|----------|---------|-----------|-------|---------------|
| No. 0 | No. 0 | No. 3 | No. 3 | $\frac{1}{4}$ |
| No. 1 | No. 1 | No. 4 | No. 4 | $\frac{1}{2}$ |
| .... | No. 2 | No. 6 | No. 6 | 2 |
| ..... | No. 3 | No. 8 | No. 8 | 2 |

Kitchen opening—not less than 1 inch.

Laundry opening—not less than $\frac{3}{4}$ inch.

Fire-place opening—not less than $\frac{1}{2}$ inch.

GAS ENGINES.

Supply for gas engine must be separate. An independent service will be required, and a governing-holder or other similar device acceptable to the Company must be used.

It is advised that before proceeding with the installation of gas engines, or piping for same, consultation be had with Gas Company.

FOR GAS ENGINES.

| Size of Engine. | Size of Pipe. | Greatest Length Allowed. | Size of Engine. | Size of Pipe. | Greatest Length Allowed. |
|-----------------|----------------------|--------------------------|-----------------|----------------------|--------------------------|
| 1 H. P. | 1 inch | 60 feet | 7 H. P. | 1 $\frac{1}{2}$ inch | 100 feet |
| 2 H. P. | 1 $\frac{1}{4}$ inch | 70 feet | 12 H. P. | 2 inch | 140 feet |
| 5 H. P. | 1 $\frac{1}{2}$ inch | 100 feet | | | |

SPECIAL NOTICE.

Gas fitters are requested to inform customers moving from one location to another that it is necessary to apply at the office of the Gas Company to have gas shut off at old and turned on at new address. This will prevent anyone using gas in their name at old location, and will also relieve them of any responsibility for bills of former tenant at new address.

This Company does not permit anyone but its own authorized employees to place any piping or connections on any part of either the outlet or inlet meter connections, turn on the gas, disconnect, move, or interfere in any way with its piping, meters or connections.

If meters are connected and customer desires to make alterations in house piping, and if to make such alterations it is necessary to disconnect meter, then the customer is required to call at the Main Office, 155 Michigan Avenue, and sign an order for the disconnection of meter, and for the resetting of it after the alterations in house-piping have been made. All charges for work of this character are payable with order.

CONNECTING APPLIANCES.

Fitters are particularly requested to see that all gas-burning appliances are connected solid with iron pipe. Under no circumstances will this Company approve of the use of lead pipe or rubber tube.

SUMMARY.

When risers are located in rear of basements or in rooms provided for that purpose, or on different floors, the building service must be brought to front of building and within 18 inches of the front wall or partition. Old or new buildings that have no basements, or in basement flats where the building service pipe is extended to the front wall over or under the joists, before floor is laid, it will be necessary for the fitter to run pipe through foundation wall, about 18 inches below the sidewalk level and 18 inches outside of wall, at a point where street service may be connected to building service, clear of walks or other obstructions.

When new piping is installed in old buildings for illumination, an independent pipe should be run for fuel, to be connected to

light riser at meter end with union or right and left coupling.

Ends of openings for fuel for kitchen must be 3 inches above floor and 2 inches clear of baseboards.

Openings for mantels or fireplaces must be $\frac{1}{2}$ inch above finished bottom of fireplace and 6 inches from side or back.

Drops must be extended $1\frac{1}{2}$ inches below unfinished ceilings or $\frac{5}{8}$ inch below finished ceilings.

Openings for vestibule, public hall and basement light in two flat buildings or over, should be taken from an independent pipe, an opening left on building service, so a separate meter may be set for hall and basement lights, or riser may be connected with union or right and left coupling to meter of the applicant, who may wish to pay for the gas used.

When running pipe for exit lights in theatres, schools, amusement and assembly halls, refer to the city building ordinance.

To avoid trapping, gas fitters must grade all pipe to riser or drops.

Branches or cross-lines of pipe from the main line must have a set not less than 4 inches dropped square, and must be well secured to joist by gas-hooks or galvanized straps.

Openings must be closed with iron caps, no split pipe or broken fittings repaired with cement or lead will be allowed.

Drops on branch lines and openings for side brackets must be square bends; no nipples allowed.

Meters will not be set where they are not easily accessible, or where they are exposed to frost or dampness, or liable to injury from any cause.

In all cases where extensions are made, care must be taken to break pipe where the size can be maintained, and in no case shall extension be made from small pipes.

Cast-iron fittings, bushings or unions concealed at any point away from the service or riser connection are not allowed. The risers in buildings must in no case be less than $\frac{3}{4}$ inch and must be run inside of inside partitions, not closer than 4 feet to any outside wall and must not extend lower than $1\frac{1}{2}$ inches below a finished ceiling and 2 inches below an unfinished ceiling and should not be higher than 9 feet from floor. Vestibule to be considered as an outside partition. The end of risers in stores must not be located under deck or bulkhead of show-window, or over any side openings for gas or electric light.

Risers for residences or apartment buildings must not end in stairway closet, or in bedroom closets or under sinks, washstands, sidewalks, bedrooms, under enclosed stairway, over side lights, over toilet stools in way of flush tank, or in basement less than 6 feet high.

In apartment buildings it is desirable to set meters in the basement or in a room provided for the purpose. If they are to be set on different floors, location should be provided so that they may be accessible without entering the apartments. Do not locate risers in laundry, furnace, or boiler room.

Risers in any building must not be less than:

2 feet from floor for 2 to 10 openings;
2 feet 6 inches from floor for 10 to 30 openings;

4 feet from floor for 30 to 60 openings;
5 feet from floor for 60 to 100 openings;
6 feet from floor for over 100 openings.

The Company reserves the right to determine in all cases the location of the meters.

In new or old buildings an opening should be provided for service pipe to pass through walls when same are being constructed. The most preferable way would be to build a sleeve of wood, rectangular shape, 12 inches by 5 inches with an inside partition about 6 inches from the street end of sleeve. Application should be made to the Superintendent of Distribution at the Gas Company's main office to locate the wall where the sleeve should be built in, so that when service pipe is run it will pass through the opening provided for it. In this way the damaging of foundation walls will be avoided.

When pipes pass through masonry, pipes must be encased, the gas-pipe resting on the bottom of the casing-pipe, with a clearance of one-half inch on top.

In all cases where pipe is to be imbedded in concrete or cement the pipe should be covered with tar paper or other suitable covering, or laid in conduit pipe.

To avoid complications, gas fitters should consult the Company before locating risers in corner buildings.

Hotels, boarding houses, restaurants, etc., should be considered special work.

Opening at meter end where risers are connected must be one size larger than the largest sized riser.

The extension of service-pipe from front to rear building should not be of less than $1\frac{1}{2}$ inch size.

BUILDING SERVICES.

In double flat buildings having but one entrance, fitters are required to extend service from various headers to the front wall and connect same, the opening for street service to be one size larger than the largest size in building service. Terminate same at front wall so that street service may be run clear of private walks or other obstructions.

In apartment buildings, one building service extended from the different group of risers to the front wall of building will answer, provided access to the different group of risers can be obtained inside of basement proper, otherwise an independent service should be extended to front wall.

STORES.

Buildings containing stores only should have a separate service for each store.

When riser ends in rear of store an independent service should be extended to front wall of basement. If there is no basement under building, fitter to run pipe through foundation wall about 18 inches below the sidewalk level, and 18 inches outside of wall at a point where street service may be connected to building service clear of walks or other obstructions.

Underground work by gas fitters between main and meter will not be accepted.

In flat buildings where appliances are installed for the joint use of tenants, such as laundry stoves, driers, etc., run pipe from each tenant's meter to laundry and provide a header with a lock-cock for each tenant. Fasten securely to each cock a metal tag with the flat number plainly marked thereon. An opening for light in laundry may be taken from end of laundry header.

Work must be proved with mercury gauge, not less than a six-inch column of mercury being allowed.

It is the purpose of this Company strictly to enforce the above rules, and no certificate of inspection will be given when they are not complied with.

Architects, builders and owners of buildings are requested not to allow bill for gas fitting unless accompanied by a certificate of inspection.

CONCERNING ARTIFICIAL ILLUMINATION.

By T. H. AMRINE

It is a fundamental principle of good artificial illumination to keep the illumination of objects as strong as is required for the uses to which they are put and to keep the intensity or brilliancy of the lights as low as possible. The first part of this principle can perhaps be readily appreciated by the average person, but the second part is directly opposed to his conception of how lighting ought to be done. It seems to him that to get good illumination a great brilliancy is required, and that anything that reduces the brilliancy of the light source tends to decrease the quality of the illumination. To understand this part of the principle it must be remembered first, that intensity or brilliancy of a light source, for example an incandescent electric lamp, refers simply to the amount of light coming from each square inch of surface on the light-giving source, that is, the filament. If a diffusing globe is put about the lamp the filament itself is not seen, and the light will appear to radiate from the entire surface of the globe. With a properly made globe the amount of light that is lost in passing through the glass is small, so that the total amount of light given off will be almost the same as from the bare lamp. The amount of light per square inch of the surface, that is, the intensity, is much less than before, since it now radiates from the entire surface of the globe instead of from the small filament. It must also be understood how the human eye acts under lights of different intensities. The eye, by means of an adjustable opening, called a pupil, endeavors to receive always a constant amount of light by contracting or dilating as the light is intense or dim. When the light reflected to the eye from any object is intense the pupil contracts so as to shut out a large part of the rays. When light of only low intensity reaches the eye from any body the pupil opens wide so as to admit sufficient light to enable the eye to see the object distinctly.

Imagine a room illuminated by an unshaded 32 candle power lamp hung rather low, and that we wish to see clearly a book on a table near the lamp. To see the book, of course some of the light must be reflected from it to the eye. Since it is close to the lamp the book receives considerable light and it would naturally be supposed that sufficient light from it would reach the eye to enable us to see it clearly. So it would if the eye were free to adjust the opening of the pupil to the intensity of the light that is received from the book. However, since the low hanging lamp itself is almost in the direct line of vision the rays from it are also reaching the eye. These rays are so intense that the eye to protect itself must almost close the pupil. In doing so it also prevents sufficient light from the book from reaching the interior of the eye, so instead of seeing the book clearly we see it only indistinctly and at the same time have an unpleasant or even painful feeling caused by the forcible contraction of the pupil. Because we do not see the book comfortably we

are erroneously led to assume that the light is insufficient.

Suppose we place over the lamp a diffusing globe, for instance a round frosted globe. The intensity of the light is now cut down a great deal, but the total amount of light is not greatly decreased. Now when we attempt to see the book the rays of light which reach the eye from the lamp itself are much less intense than before. Hence the pupil is left more widely open, and even though less light is reaching the book than when the lamp was unshaded, the eye is enabled to receive more reflected light from it, and the book can be seen more clearly. Moreover, because the pupil is not so closely contracted, the eye feels much more comfortable, and the dazzling effect is much decreased.

Let us make one more change. Let us raise the lamp high enough so that the direct rays from it will not reach our eyes when we look at the book. Now as we have taken the lamp further from the book so that it receives less light than before, we will remove the round globe and replace it with a tulip or bell-shaped shade. This will deflect the light from the lamp downward so that the book will receive about the same amount of light as formerly. Now when we look at the book there is no direct light from the lamp reaching the eye. Hence, the pupil can adjust itself to receive the proper amount of light from the book, and, since the book itself is receiving sufficient light from the lamp, the eye will receive enough reflected rays from it so that it can be seen clearly.

In our attempt to illuminate the book so that it could be seen clearly and comfortably, it will be noticed that our efforts have been directed, first, towards getting the light upon the book and second, towards diffusing the light, or towards keeping the light screened from the direct line of ordinary vision. These results should be the end toward which all efforts in illumination are directed. They are obtained by the careful placing of the lights, and by the use of proper shades and globes.

Contrary to the popular idea, the selection of shades and globes should not be made primarily with regard to their decorative qualities. Properly designed and constructed shades and globes are made either to send the light in some desired direction, to diffuse the light, i. e., decrease its intensity, or to combine the two purposes. A person selecting a shade for a light should then bear in mind the location of the light, where the strongest illumination is desired, and whether the light needs to be diffused. A shade or globe should then be selected that will fulfill the required conditions. Many manufacturers will furnish diagrams showing how each particular shade or globe made by them diffuses and distributes the light. From these diagrams the proper selection can best be made.

Taken from Bulletin No. 25, Engineering Experiment Station, University of Illinois.



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REGULATIONS GOVERNING CHICAGO EDISON COMPANY'S SYSTEM.

INSPECTION.

All wiring which is to be connected to the mains of this Company must be installed in accordance with the rules and requirements of the Department of Electricity of the City of Chicago and the Chicago Underwriters' Association. A "certificate for installation" or "temporary current permit" from said Department of the City must be presented at the office of the Inspection Department of this Company before current can be used on any wiring for which such certificate or current permit has not been issued. When wiring has been installed for additional lights or power, this certificate or current permit must also be presented as in the case of an original installation. The Company should be notified whenever any additional apparatus is desired to be connected to consumer's wiring in order to avoid interruption of consumer's service and injury to the Company's meters or other apparatus. The Company will make the final connection of all wiring to its mains.

DIRECT CURRENT TERRITORY.

Current is supplied from the Edison three-wire direct current system in approximately the following territory:

South of Menomonee Street east and north of the Chicago River.

West from the Chicago River to Morgan Street between Kinzie Street and Twenty-second Street, except on Milwaukee Avenue, where the direct current extends to Wood Street; on West Madison, where it extends to Ashland Ave., and on Blue Island Avenue, where it extends to Throop Street.

In the "down town" district. On the south side to Thirty-fifth Street between Stewart Avenue and Cottage Grove Avenue.

From Thirty-fifth to Thirty-ninth between Dearborn Street and Grand Boulevard, and on Cottage Grove Avenue from Thirty-fifth to Thirty-eighth Streets.

ALTERNATING CURRENT TERRITORY.

Current is supplied from the alternating current Edison three-wire system for lighting and small power in all parts of the City, other than those above described, where the Company has lines.

Current is supplied for power from the three-phase system in a large part of the alternating territory, but inquiry should be made of the Inspection Department at the nearest district office as to the proximity of three-phase lines to any particular location where power may be desired.

SERVICES.—UNDERGROUND.

The consumer's wiring must be extended to the Company's nearest service where sidewalks are excavated and provided with the necessary service switch and cut-outs, unless the premises in which current is to be used are more than 50 feet from the nearest service. In this case, application should be made to the Company to have a service installed.

In case it is necessary to extend service inside of the property line in order to reach the building, the expense of the installation of the portion inside the property line must be borne by the consumer. Final connection of the wiring to the service will be made by this Company in all cases.

OVERHEAD.

The consumer's wiring must be brought outside the building wall at some point at least 25 feet above the ground, so located that it will be readily accessible to service wires brought from the Company's nearest pole. In case the pole line from which service is to be given is not in position at the time interior wiring is being done inquiry should be made at the district office for information as to its proposed location.

Inside wiring must not be brought out of the building in an inclosed air shaft, as the City ordinance forbids the erection of wires across a roof to reach wires in such a place.

The location of service outlets on a party wall is also forbidden by City ordinances.

ALTERNATING CURRENT MOTOR AND ARC LAMP.

On the alternating current system, separate services will be provided as follows:

For motors of one horse-power or larger and for arc lamps where a large installation is made.

Inquiry should be made of the Inspection Department in all cases where more than ten alternating arc lamps are being wired, as to whether incandescent and arc lamps may be wired to the same service.

Separate mains and meter loops are of course necessary for all wiring fed by separate services.

METERS.

Meter loops must be provided in the mains at an accessible point, and so arranged that the meter may be mounted with ordinary wood screws on the wall. A meter board must be provided of sufficient size to allow the installation of a recording watt meter and maximum demand meters. Two demand meters are installed on three-wire mains. Sufficient space must be provided about the meters to allow the removal of the case. Meter loops should not be placed above seven feet from the floor.

In office buildings meter loops should be located at a central point in meter closets or public corridors, and in apartment buildings in the basement of the building, so that meters may be installed and maintained without annoyance to tenants.

MOTORS.

Wiring for motors should be so arranged that the current used for power purposes may be metered separately from that used for lighting. Wiring for elevators should also be arranged so that current used on elevators may be metered separately from that used for other power.

All motors larger than 1 horsepower must be wound for 220 volts, and it is preferred that motors of three-fourths horsepower and larger be so wound.

Alternating current motors must be designed to operate at a frequency of 60 cycles.

No motors larger than 5 horsepower will be supplied on single-phase system, except by special permission, given by the Inspection Department of the company in each case.

Motors of 5 horsepower and larger will be supplied on the three-phase system at 60 cycles, 220 volts.

No motor will be connected which requires more than three times full load current in starting without load.

INCANDESCENT LAMPS.

Standard shape Edison base incandescent lamps will be furnished free of charge for installations and renewals, unless otherwise provided for by the terms of the contract, in 4, 8, 10, 16, 24, 32 and 50 candle-power sizes.

One lamp will be furnished for each socket installed in the customer's premises at the time the installation is made. Additional lamps will be furnished at any time when additional sockets have been wired. A reserve supply of lamps, equal to approximately 10 per cent of the customer's total installation, will be advanced for convenience in making renewals. When burned out or blackened, lamps will be renewed free of charge (except special lamps) upon presentation of the old lamps with glass intact at the nearest lamp renewal station, or lamps will be delivered to customers' premises on request.

All lamps furnished for installation, reserve or renewal remain the property of the company. The consumer must, therefore, give his receipt for all lamps delivered to him for installation, reserve or renewal, agreeing to pay for lamps unaccounted for at 20 cents each.

ARC LAMPS.

Arc lamps having a standard black finish are provided by the company for the consumer's use free of charge. Lamps having ornamental finish will be supplied only at an extra charge.

Lamps furnished by the company will be cleaned and trimmed by the company free of charge when used for general lighting purposes. Arc lamps used for photographing or other purposes than general illumination must be provided and maintained at the consumer's expense. A hanger board must be provided for use in hanging inside lamps and a suitable crane provided with a hook must be provided for outside lamps. They must be installed so that the bottom of the lamp will not be less than eight feet above the ground when it is hung, the length of the lamps being about 40 inches. If it is necessary to install lamps beyond the reach of a six-foot step-ladder, some arrangement must be made for lowering the lamp so that it may be trimmed.

See section on "Services" for special regulations regarding alternating arc lamps.

SUGGESTIONS FOR THE PROVISIONS OF WIRING AND CABLING OF BUILDINGS FOR TELEPHONE SERVICE.

The extensive use of the telephone at the present time in all classes of buildings, renders it imperative that some provision be made for the large number of wires necessary to provide telephone service.

A pair of wires are necessary for each telephone, and these wires must be carried to some central point in the building. The importance of making adequate provision for this service within the finish of the building is apparent. If some arrangement is not included in the building plans open wire runs will be necessitated, and alterations will have to be made after the completion of the building.

The following is a brief outline of satisfactory schemes of wiring various buildings. This is submitted for the information of Architects and builders.

In general, the wiring of buildings of each class will be uniform. On account of the conditions varying in each building with respect to telephone service, the probable requirements must be estimated as closely as possible. The Telephone Company will be pleased to give their service in advising owners and architects in this connection. With reference to wiring for telephone service, buildings may be divided into general classes.

First: Hotels, hospitals, clubs and apartment houses.

Second: Office buildings, commercial houses and factories.

The characteristics that make a broad distinction between the wiring of these two classes are as follows:

In Class No. 1 a maximum number of telephones in any one room or on any floor is definitely fixed. The whole building may thus be permanently wired.

In Class No. 2 the wiring of buildings for telephone service presents a more difficult problem, for the following reasons:

The number of telephones will depend largely upon the character of the business and district. The number of telephones on any floor of these buildings will depend upon the requirements of the individual tenants. This is not constant for any extended period, as tenants may from time to time be replaced by others using more or less service.

Hotels, Club Houses, Hospitals, Commercial Houses, and Factories.—The telephone system installed in these buildings consists of a telephone switchboard and cross connecting box located at some convenient point, usually on the ground floor in or near the office. The telephones are placed at the desired locations and wired to the cross-connecting box, which is connected by one or more trunk lines with the nearest exchange of the telephone company; thus provision should be made so that the telephone company can run these trunk lines to the above box from the point at which the service cable enters the building. A 2-inch conduit is sufficient for this purpose. One or more distributing boxes are provided on each floor. These boxes should be placed in the walls above the baseboard, and a conduit extended to the cross-connecting box. In hotels, hospitals and clubs the telephone conduit consists of an outlet box placed in each chamber. The present practice is to loop an average of ten outlets and extend a large conduit to the distributing boxes, thus the conduit tapers down to a $\frac{1}{2}$ -inch conduit, at the last outlet. In commercial houses and factories the system of distributing conduits in general is the same as mentioned above. It briefly consists of outlets placed in the baseboard of each or every other column, or of floor boxes placed at 5-foot centers. Distributing boxes should also be provided on the various floors, and conduit installed to the cross-connecting box. This cross-connecting junction box is used for connecting the house cables and service cable with the switchboard. Several 2-inch conduit or cable runways should be installed between the switchboard and cross-connecting box in order to convey the switchboard cables between the above points.

Office Buildings.

In office buildings the service cable is brought into the building through a sub-duct from the vault in the street or alley and extended to the cross-connecting box, which is located at some convenient place in the basement near the telephone wire shafts. One or more distributing boxes, depending upon the floor area, are established on each floor, at points adjacent to the telephone shafts. From the cross-connecting box cables are extended to and up the shafts to the distributing boxes. The house cables and service cables are terminated in the cross-connecting boxes, so that connections can be made between the two sets of cables.

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DEPARTMENT OF ELECTRICITY. CITY OF CHICAGO.

NOTICE.

Particular attention is called to the different sections of the ordinance herein printed: Permit must be obtained before any work is done.

The use of electric current is prohibited previous to certificate being issued.

Conditions unsafe to life or property must be corrected within forty-eight hours.

Each building into which electric current shall hereafter be introduced shall have independent service from the street or alley, entering at right angles with the street curb, except where the service wires are placed in conduits complying with the rules of the department of electricity; and no wires hereafter put up shall pass from one building to another through any party wall or along any building wall or over any roof or under any sidewalk, except where such conduits are used.

Current must not be supplied from trolley lines for motors or light except for power stations owned by company.

Temporary work must be inspected and approved before current is used.

Alterations to existing wiring must not be made without regular permit.

Permits issued by the Commissioner of Public Works for electrical work to be done on streets must be countersigned by the Department of Electricity.

Violation of any of the Sections of this ordinance constitutes a misdemeanor and renders any person, firm or corporation liable to arrest and fine of not less than \$50 or more than \$100, also the cutting off and stopping of current used in violation until the provisions are complied with.



City Electrician.

SPECIAL SUGGESTIONS TO ARCHITECTS.

The Department of Electricity will not allow more than twelve (12) sockets to be attached to one circuit.

Architects are urged to make definite specifications for electrical work, for the benefit of both the electrical contractor and the fixture contractor, specifying the number of outlets in each job for the electrical contractor to follow, and the exact number of 16-candlepower lamps to be used.

Frequently the fixture contractor installs more than twelve lights on a circuit, which is in violation of the city ordinances, and causes the consumer very much annoyance in getting electric current to his premises.

It is also suggested that the architects demand of the electrical contractor that he make up all connections and combinations relative to switches, complicated outlets, etc., leaving only two wires for the fixture hanger to make his fixture connections.

GENERAL SUGGESTIONS.

In all electric work conductors, however well insulated, should always be treated as bare, to the end that under no conditions, existing or likely to exist, can a grounding or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to the minimum.

In all wiring special attention must be paid to the mechanical execution of the work. Careful and neat running, connecting, soldering, taping of conductors and securing and attaching of fittings, are especially conducive to security and efficiency, and will be strongly insisted on.

In laying out an installation, except for constant-current systems, the work should, if possible, be started from a center of distribution, and the switches and cutouts, controlling and connected with the several branches, be grouped together in a safe and easily accessible place, where they can be readily got at for attention or repairs. The load should be divided as evenly as possible among the branches, and all complicated and unnecessary wiring avoided.

SPECIAL NOTICE.

Place all service switches, meters and cut-outs, when practicable, in basements or public places where they will be readily accessible to inspectors, meter readers and trouble men, in order to obviate the necessity of interfering with tenants of apartments. It often occurs that tenants of apartment buildings who are not using electric current are annoyed by the visits of inspectors and trouble men in their necessary duties in making inspections or repairs for other tenants.

The placing of meters in basements or halls will largely do away with the annoyance caused by their disagreeable humming and it will be much more satisfactory to all concerned.



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ELECTRICAL INSTALLATIONS

Sections of Revised Code of City of Chicago, Governing Electrical Inspections.

March 20, 1905.

CHAPTER XXII—DEPARTMENT OF ELECTRICITY.

807. Electric Current.—No electric current shall be used for lighting, heating or power purposes except as hereinafter provided.

808. Application—Contents—Permits.—All persons or corporations desiring to install wires or other apparatus for the use of electric currents for any of the purposes mentioned in the foregoing section shall, before commencing or doing any electrical construction work of any kind whatever, either installing new electrical apparatus or repairing apparatus already in use, file an application for a permit therefor in the office of the City Electrician, which application shall describe in detail such material and apparatus as it is desired to use, with a full description of the same, giving the locality by street and number; and upon receipt of which application, if found proper, such permit shall be given.

809. Duties of City Electrician Thereon.—The said City Electrician shall have power, and it shall be his duty, when by him deemed necessary, to carefully inspect any such installation previous to and after its completion, and it shall be competent for him to remove any existing obstructions which may prevent a perfect inspection of the current carrying conductors, such as laths, plastering, boarding or partitions; and if such installation shall prove to have been constructed in accordance with the rules and regulations of the Department of Electricity, controlling the use of electric current, upon the payment of a fee, as herein provided, he shall issue a certificate of such inspection, which shall contain a general description of the installation and the date of such inspection. Any owner installing or causing to be installed any electric wires to be hidden from view shall, prior to such installation, give said city electrician a reasonable notice in order to give ample time for inspection. The use of electric current is hereby declared to be unlawful previous to the issuance of such certificate; provided, however, the City Electrician may issue a temporary permit for the use of electrical current during the course of construction or alteration of buildings, which permit shall expire when the electrical apparatus for such building is fully installed.

Amended June 29, 1908, to read as follows:

810. (Certificate—Wiring Only and Complete Installations.)—A final certificate for wiring only may be issued by said City Electrician in the case of completed wiring installation, but upon which no current shall be used in the immediate future. Such certificate shall show that at the date of inspection the installation was constructed and erected in accordance with the terms of this chapter, and shall be issued at nine-tenths the rates hereinafter named for complete installation.

Prior to the introduction of electric current into the said premises a second inspection shall be made, when, if the said installation be still in accordance with the terms of this chapter, and the fixture work be correct, a final certificate for complete installation and service shall be issued and the amount of the fee paid for the final certificate for wiring only shall be deducted from the fee for the final certificate for complete installation and service.

811. Power of City Electrician—Inspections and Re-inspections.—The said City Electrician is hereby empowered to inspect or re-inspect all overhead, underground and interior wires and apparatus conducting electric current for light, heat or power, and when said conductors or apparatus are found to be unsafe to life or property, he shall notify the person or corporation owning, using or operating them to place the same in a safe and secure condition within forty-eight hours. Any person or corporation failing or refusing to repair, change or remove the same within forty-eight hours, or within such further time as the city electrician shall determine is necessary, after the receipt of such notice, shall be subject to the penalty hereinafter provided.

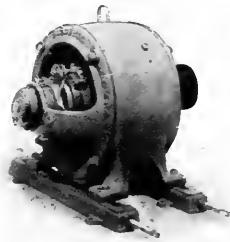
812. Poles—Covers—Wires—Electric Service Entrances—Switches.—All poles now standing or hereafter erected, and all covers for manholes now in service, or hereafter placed in service for the use of electric conductors, shall be branded or stamped with the name of the person or corporation owning the same; all electric service entrances shall have attached to the conductor or conductors, in a conspicuous place, a substantial tag designating the owner, and giving such a full description of the conductors as shall meet with the approval of said City Electrician; and all of said electric service entrances shall be properly equipped with approved cut-out service switches. Each building into which electric current shall hereafter be introduced shall have independent service from the street or alley, entering at right angles with the street curb, except where the service wires are placed in conduits complying with the rules of the department of electricity; and no wires hereafter put up shall pass from one building to another through any party wall or along any building wall or over any roof or under any sidewalk, except where such conduits are used. No electric current shall be supplied from any trolley line for any purpose whatever to any building except for lighting the power stations from which current is supplied to such trolley lines.

Amended June 29, 1908, to read as follows:

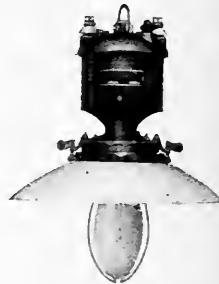
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**E. J. SAXE,
Secy.**

813. Fees.—There shall be collected by the City Collector for completed installations, prior to the issuance of certificate permitting the use of electric current, the following fees, in the following manner:

For the inspection of each of the first two arc lamps, one dollar; for three arc lamps, two dollars and eighty cents; for four arc lamps, three dollars and sixty cents; for five arc lamps, four dollars and forty cents; for six arc lamps, five dollars and ten cents; for seven arc lamps, five dollars and eighty cents; for eight arc lamps, six dollars and fifty cents; for nine arc lamps, seven dollars and twenty cents; for ten arc lamps, seven dollars and ninety cents; for above ten to twenty arc lamps, sixty cents each; twenty arc lamps, thirteen dollars and ninety cents; for above twenty to thirty arc lamps, fifty cents each; for thirty arc lamps, eighteen dollars and ninety cents; for above thirty arc lamps, twenty-five cents each.

For incandescent lamps consuming nominally fifty watts each, as follows: For each of the first twenty-five incandescent lamps, ten cents; for each of the next twenty-five lamps, nine cents; for each of the next twenty-five lamps, eight cents; for each of the next twenty-five lamps, seven cents; for each of the next one hundred lamps, six cents; for each of the next one hundred lamps, five cents; for each additional lamp above three hundred, four cents; and for larger and smaller lamps under five hundred watts in the same proportion.

For the inspection of incandescent lamps consuming five hundred watts and over: For each of the first two lamps, one dollar; for each of the next three lamps, eighty cents; for each of the next five lamps, seventy cents; for each of the next ten lamps, sixty cents; for each of the next ten lamps, fifty cents; for each additional lamp above thirty, twenty-five cents.

For each electrical horse power of seven hundred and forty-six watts used for mechanical or other purposes than above mentioned, the sum of one dollar for each horse power from one to five horse power, inclusive; for each of the next succeeding five horse power, seventy-five cents; for each of the next succeeding five horse power, sixty-five cents; for each of the next succeeding ten horse power, fifty-five cents; for each of the next succeeding twenty-five horse power, fifty cents; for each additional horse power, twenty-five cents.

Arc Lamps and Incandescent Lamps of 500 Watts and Over.

| | Each |
|--|------|
| 2 lamps @ \$1.00, \$2.00; above 2 lamps to 5 @ | .80c |
| 5 lamps 4.40; above 5 lamps to 10 @ | .70c |
| 10 lamps 7.90; above 10 lamps to 20 @ | .60c |
| 20 lamps 13.90; above 20 lamps to 30 @ | .50c |
| 30 lamps 18.90; above 30 lamps @ | .25c |

Incandescent Lamps.

For incandescent lamps consuming nominally fifty watts each, as follows:

| | Each |
|--|------|
| 25 lamps, \$2.50..... above 25 to 50 lamps @ | .9c |
| 50 lamps, 4.75..... above 50 to 75 lamps @ | .8c |
| 75 lamps, 6.75..... above 75 to 100 lamps @ | .7c |
| 100 lamps, 8.50..... above 100 to 200 lamps @ | .6c |
| 200 lamps, 14.50..... above 200 to 300 lamps @ | .5c |
| 300 lamps, 19.50..... above 300 @ | .4c |

For larger and smaller lamps under five hundred watts in the same proportion.

No inspection shall be made for a less amount than one dollar.

Inspections of electric meters, temporary installations for show window exhibitions, conventions and the like, shall be charged for according to the time required for such inspections at the rate of seventy-five cents per hour.

Each reinspection of any overhead, underground or interior wires or apparatus shall be charged for according to the time required for such reinspection at the rate of seventy-five cents per hour.

On each installation where a permit has been issued and work not sufficiently completed within three months for wiring only certificate to be issued, and where inspection has been made on such work, a portion of the regular fee must be charged to cover the cost of such inspection, which will be credited on the final certificate.

Immediately after the inspection provided for in Section 809, the City Electrician shall make a fee bill, in duplicate, on a form to be approved by the City Comptroller, and shall forward the same to the Comptroller to be recorded and rendered. The person, or corporation, receiving the fee bill, shall pay the amount thereof, to the City Collector, who shall endorse payment thereon and enter the fee bill and payment in a book in his office, to be provided for that purpose, and thereupon the City Collector shall deliver the paid fee bill to the person, or corporation, paying the same. The paid fee bill shall then be presented to the City Electrician at his office and thereupon the City Electrician shall issue the wiring only or final certificate for completed in

stallation provided for in Section 810.

814. **Alterations.**—No alterations shall be made in any electrical installation without first notifying the said City Electrician and submitting the same for inspection in the same manner as provided for new work.

815. **Penalty.**—Any person or corporation furnishing or using any electric current within the city, in violation of any of the provisions of this chapter, or contrary to any of the rules and regulations of the Department of Electricity, shall be fined not less than fifty dollars nor more than one hundred dollars for each offense, and each day's use thereof contrary to the provisions of this chapter shall constitute and be a separate and distinct offense. Said City Electrician may, for any violation of the provisions of this Chapter, also order and compel the cutting off and stopping of such current until the provisions of this Chapter are fully complied with.

Table of Carrying Capacity of Wires.

| B. & S. G. | Concealed Work. | | Open Work. Amperes. |
|------------|-----------------|-----------------|------------------------|
| | Amperes. | Concealed Work. | |
| 18 | 3 | | |
| 16 | 6 | | |
| 14 | 12 | | 19 |
| 12 | 17 | | 24 |
| 10 | 24 | | 32 |
| 8 | 33 | | 43 |
| 6 | 46 | | 57 |
| 5 | 54 | | 63 |
| 4 | 65 | | 74 |
| 3 | 76 | | 83 |
| 2 | 90 | | 98 |
| 1 | 107 | | 117 |
| 0 | 127 | | 140 |
| 00 | 150 | | 157 |
| 000 | 177 | | 185 |
| 0000 | 210 | | 225 |

Table of Carrying Capacity of Wires.—Continued.

| Circular Mills. | Concealed Work. | | Open Work. Amperes. |
|-----------------|-----------------|-----------------|------------------------|
| | Amperes. | Concealed Work. | |
| 200,000 | 200 | | 285 |
| 250,000 | 235 | | 355 |
| 300,000 | 270 | | |
| 350,000 | 300 | | 377 |
| 400,000 | 330 | | 415 |
| 500,000 | 390 | | 485 |
| 600,000 | 450 | | 545 |
| 700,000 | 500 | | 600 |
| 800,000 | 550 | | 655 |
| 900,000 | 600 | | 719 |
| 1,000,000 | 650 | | 765 |
| 1,100,000 | 690 | | |
| 1,200,000 | 730 | | |
| 1,300,000 | 770 | | |
| 1,400,000 | 810 | | |
| 1,500,000 | 850 | | |
| 1,600,000 | 890 | | |
| 1,700,000 | 930 | | |
| 1,800,000 | 970 | | |
| 1,900,000 | 1,010 | | |
| 2,000,000 | 1,050 | | |

The lower limit is specified for rubber-covered wires to prevent gradual deterioration of high insulations by heat of wires, but not from fear of igniting the insulation. Question of drop is not taken into consideration in above tables.

The carrying capacity of sixteen and eighteen wire is given, but no smaller than fourteen is to be used, except as allowed under Rules 24 u and 40 c.

Materials.

The following is a list of non-combustible, non-absorptive, insulating materials for the benefit of those who might consider hard rubber, fiber, wood and the like as fulfilling the requirements.

1. Glass.
2. Marble (filled).
3. Slate without metal veins.
4. Porcelain, thoroughly glazed and vitrified.
5. Pure Sheet Mica.
6. Lava (certain kinds of).
7. Alberene Stone.

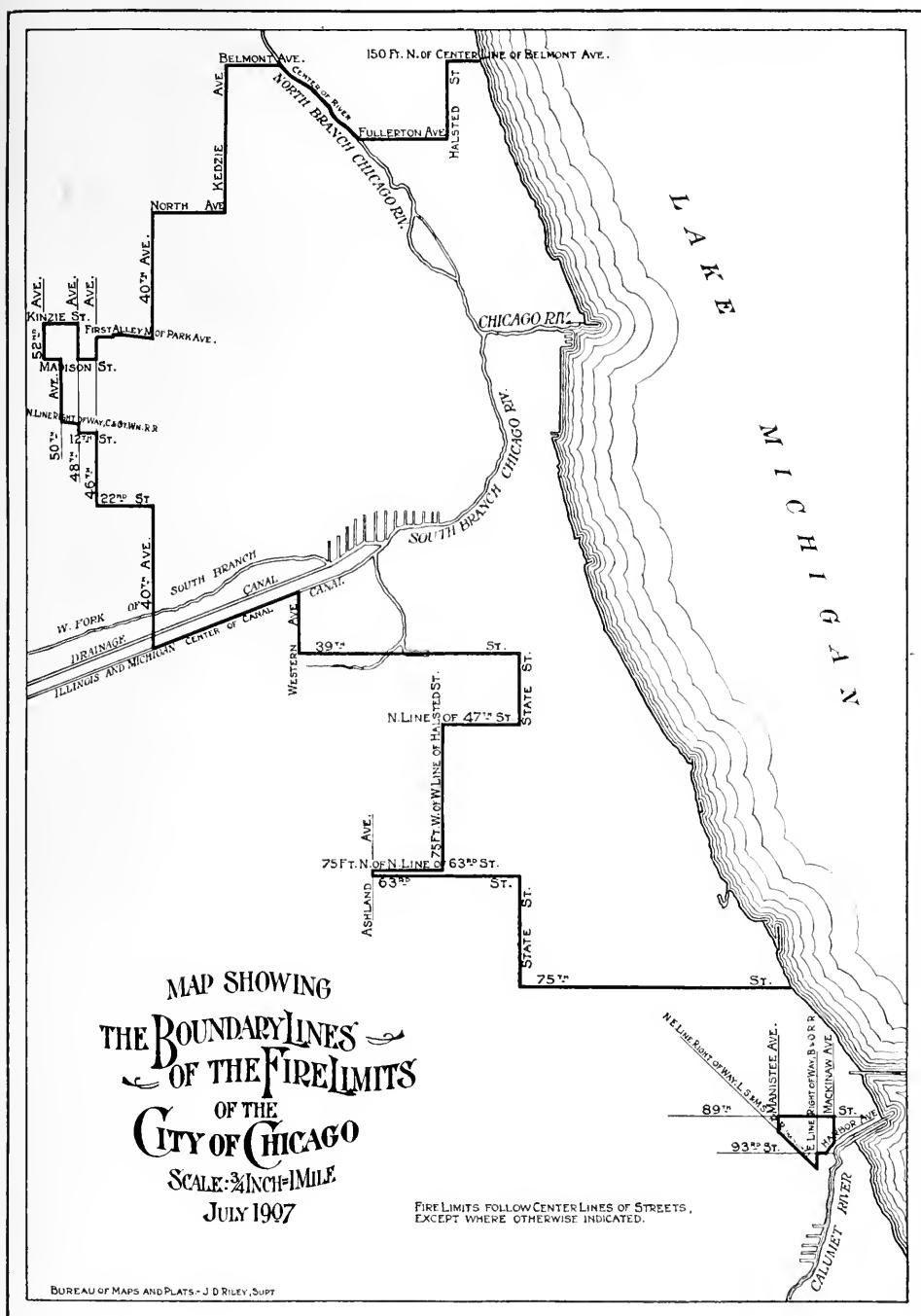
Electric Gas Lighting—

Electric gas lighting must not be used on the same fixture with the electric light.

816. **Electric Lighting Facilities—Indemnity.**—The city electrician is authorized to execute and deliver in the name of the city of Chicago to any person or corporation affording facilities for any of the city's electric lighting property, contracts of indemnity to hold such person or corporation harmless from all injuries, damages or expense to any persons or property arising in any way out of the city's exercise of such facilities, when such facilities are not afforded under the requirements of ordinances held by them.

817. **City Electrician in Control.**—The City Electrician shall have charge and control of and shall erect all lamp posts and lamps, and street signs designating the names of the streets which shall be placed on said lamps.

MAP SHOWING THE BOUNDARY LINES OF THE FIRE
LIMITS OF THE CITY OF CHICAGO.



MAP SHOWING
THE BOUNDARY LINES
OF THE FIRE LIMITS
OF THE
CITY OF CHICAGO
SCALE: $\frac{1}{2}$ INCH = MILE
JULY 1907

FIRE LIMITS FOLLOW CENTER LINES OF STREETS
EXCEPT WHERE OTHERWISE INDICATED.

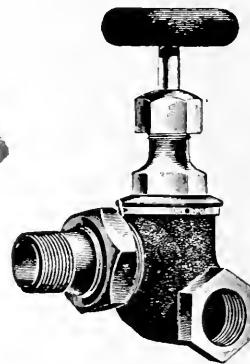
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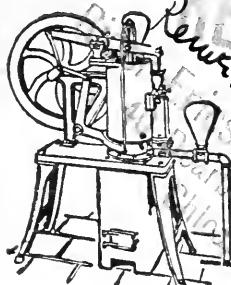
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HINTS ON HEATING AND VENTILATING AND FORMULA ON SAME.

Edited by HOMER R. LINN, Mech. Engr.

HEATING.

Steam heating may be classified under a number of different heads, although the two prominent systems are the gravity and vacuum systems. These may be subdivided into up-feed, down-feed, double pipe, single pipe, indirect, direct, etc.

The gravity system is the one in which the condensation falls by its own weight and returns either to the boiler, hot well or receiver, through either a wet or dry return. Where it is possible a system should be so installed that it could operate as a gravity system, even though a vacuum system is contemplated in connection with it.

In the vacuum systems the condensation is usually pumped back by means of a vacuum pump and some form of thermostatic valve. Where a building is heated by exhaust steam from an engine it is sometimes advisable to install vacuum systems, but where such a system is installed the contractor should guarantee to operate the system without any back pressure whatever on the engine. This guarantee should be so drawn that in case he could not produce these results with his apparatus, he would allow his apparatus to remain in service at the option of the purchaser, without any cost whatever to the purchaser. Where a vacuum system is installed no radiator air valve is necessary, other than those supplied by the vacuum company. All systems which are operated without vacuum should have an air valve placed on each radiator. It is not absolutely necessary, but is very desirable to have these air valves automatic. There are a number of automatic air valves on the market which are simple, effective and inexpensive.

It is very essential that all radiators, piping, fittings, etc., should be thoroughly cleaned before the air valves are applied.

As to the size of mains, Professor Carpenter says: "The area of the main pipe must in every case be equivalent in carrying capacity to that of all the branches taken off; it consequently may be reduced as the distance from the boiler becomes greater or as more branches are supplied. It will in general be found, except when large pipes are used, less expensive to run the main full size rather than to use reducing fittings."

Find the area by multiplying the amount of radiating surface. If 1,400 feet or less, by .009; if 1,600 feet or more, by .008, and then use pipe with area nearest to that so found; thus radiating surface pipe will supply:

SIZES OF STEAM MAINS.

| Radiation | One Pipe Work | Two Pipe Work |
|------------------------|---------------|---------------|
| 125 square feet | 1½ inch | 1¼ × 1 inch |
| 250 square feet | 2 inch | 1½ × 1¼ inch |
| 400 square feet | 2½ inch | 2 × 1½ inch |
| 650 square feet | 3 inch | 2½ × 2 inch |
| 900 square feet | 3½ inch | 3 × 2½ inch |
| 1250 square feet | 4 inch | 3½ × 3 inch |
| 1600 square feet | 4½ inch | 4 × 3½ inch |
| 2050 square feet | 5 inch | 4½ × 4 inch |
| 2500 square feet | 6 inch | 5 × 4½ inch |
| 3600 square feet | 7 inch | 6 × 5 inch |
| 5000 square feet | 8 inch | 7 × 6 inch |
| 6500 square feet | 9 inch | 8 × 6 inch |
| 8100 square feet | 10 inch | 9 × 6 inch |

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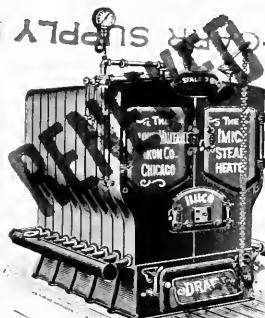
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HOT-WATER HEATING.

Heating by means of hot water has been in universal use for a number of years. There are two principal systems of hot-water heating—the open tank, or low pressure, and the closed tank, or high pressure.

In the open-tank system the water can never be hotter than 212° F., while in the closed tank it may be considerably higher, depending entirely upon the amount of pressure carried on the system.

In determining the size of a boiler required for a hot water job it must be borne in mind that all piping, including mains and risers, both flow and return, should be figured as radiating surface and added to the radiating surface of the radiators themselves. When a hot water back consisting of either a coil of pipe or a cast iron section is introduced into the fire pot for the purpose of heating water for domestic use, it must also be taken into consideration in determining the size of the boiler.

Hot water heating apparatus cannot be too generous in its proportions, as low temperatures depend upon the size of the radiators, and slow combustion depends upon the size of the boiler. Slow combustion means economy. Comparing size of radiators with those of the steam apparatus, they should be at least as 8 is to 5, that is to say, that a radiator for hot water for a given space should be three-eighths larger than one for steam to heat the same space. It should be understood, also, that all hot water apparatus is always under pressure to the extent of the height of the column of water, one pound pressure for every 27 inches of height of the column.

In the open tank system the basement piping consists of supply and return mains of the same size running parallel or with return directly under the flow pipes and pitching upward from the boiler. What is known as the trunk system consists of one supply and one return main of equal size. These are run in pairs and each radiator has supply and return of same size.

Each radiator has a valve and union ell at the opposite end of it. If one main only is used the radiators on first floor should be supplied direct and should have larger connections. Radiators on the second and upper floors can be supplied from one branch. The ends of supply and return should be larger than the supply riser.

To find the size of mains multiply the radiating surface: When 1,800 feet and less, by .011; when 2,000 feet and over, by .009.

| Size of Main. | Area. | Direct | Indirect |
|-----------------|-------|---------------------------|---------------------------|
| | | Radiation Will Supply, | Radiation Will Supply, |
| 1½ inches | 2.03 | 200 | 135 |
| 2 inches | 3.35 | 325 | 200 |
| 2½ inches | 4.78 | 450 | 300 |
| 3 inches | 7.38 | 700 | 450 |
| 3½ inches | 9.82 | 900 | 600 |
| 4 inches | 12.73 | 1200 | 800 |
| 4½ inches | 15.93 | 1500 | 1000 |
| 5 inches | 19.99 | 2000 | 1200 |
| 6 inches | 28.88 | 3000 | 2000 |
| 7 inches | 38.73 | 4200 | 2800 |
| 8 inches | 50.03 | 5600 | 3600 |
| 9 inches | 63.63 | 7000 | 4600 |
| 10 inches | 78.83 | 8500 | 5600 |

In the case of water being used, an expansion tank is necessary, for as the temperature of water rises until at the boiling point it is 5 per cent. greater than at 40 degrees the increase must be provided for, so that when cooled the system will still be full of water. It should be placed at a point above the highest radiator, the supply and return to it being conected to the supply and return of the nearest radiator, at a point below the radiator connection. No valves should be placed at any point that can possibly close the connection between the boiler and the tank.

To find the size of tank in gallons required, multiply the square feet of surface in the radiators, if the amount is less than 1,000 square feet, by .03; between 1,000 and 2,000 square feet., by .025; over 3,000 square feet, by .02.

An altitude gauge placed near the boiler will save watching the expansion tank. Fill the expansion tank to a point half way up the glass, and set the red hand of the gauge to indicate that point, and the movement of the movable hand will indicate the relative position of the water in the tank.

Ascertain the dimensions of room, the number of square feet of glass surface in windows and outside doors, figuring these doors as if glass, and measuring the entire opening of windows and door-frames. Ascertain the square feet of exposed wall surface, and deduct the glass surface as obtained above, and this will be the net amount of wall

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exposure. Reduce the wall surface to the equivalent of glass surface by dividing the net amount of wall exposure by 10 if the wall is from 8 to 10 inches thick, by 15 if from 12 to 26 inches thick, and by 20 if the wall is 26 to 38 inches thick. This result, added to the glass exposure, gives the glass equivalent of the glass and wall exposure. Multiply this glass equivalent by 75 (the cubic feet of air that each square foot of glass will cool per hour), and the product is the cubic feet of air to be heated to overcome the cooling effect of the glass and wall exposure. Now add to this the cubic contents of the room, and we have the total quantity of air to be heated.

In localities where the temperature falls below zero, add to the amount of radiation obtained 1 per cent. for every degree below zero.

For Hot Water.—For temperature of water in radiators, 160 degrees, multiply by .0092; water in radiators, 170 degrees, multiply by .0081; water in radiators, 180 degrees, multiply by .0072.

For water use the multiple .0092; for if water is 175 degrees in flow and 145 degrees in return, the average is 160 degrees in radiation.

This is based upon using direct radiation, and provides for one change per hour. For more frequent changes increase the cubic contents by as many times as it is desired to change the air, the multipliers remain the same.

Direct radiation is surrounded by warm air, but cold air comes in contact more or less with their surfaces, in direct-indirect and indirect systems, so that for direct-indirect add 25 per cent. and for indirect 50 per cent.

EXAMPLE FOR DIRECT RADIATION.

Room— 16 feet wide, 20 feet long, 10 feet high.

4 windows, 3 feet wide, 5 feet high.

2 sides of room exposed to 0° weather.

10 inches thickness of wall.

$16 \times 20 \times 10 = 3200$ cubic feet of air in room.

$3 \times 5 \times 4 = 60$ square feet of glass in windows.

$16 + 20 \times 10 = 360$ square feet of wall surface exposed, including glass.

$360 - 60$ (glass) = 300 square feet actual amount of exposed wall surface.

$300 \div 10 = 30$ — glass equivalent in wall exposure.

$30 + 60 \times 75 = 6750$ — air in cubic feet cooled by windows and walls.

$3200 + 6750 = 9950$ — total in cubic feet of air to be heated.

$9950 \times .0055$ (multiplier for steam) = 54.72 radiation in square feet required to heat room.

Indirect radiation is adopted where a large amount of ventilation is desired. It is particularly necessary in schools, hospitals and churches, and in dwellings one or two indirect stacks are desirable. This method of heating is decidedly more expensive than all direct radiation, and consumes more coal. It is frequently used in combination with direct radiation, and in this case ventilating flues must be provided. Either fireplaces or special flues from each apartment so warmed to the open air, and these flues (as well as from those conducting heat) must be placed in inside walls or partitions.

In installing this system the heating stacks are placed in the basement, connected to main supply and return pipes and encased with either galvanized iron, or narrow ceiling lined with tin. The cold air is introduced through air ducts from the outside, and after being warmed by contact with the indirect heating surfaces, is introduced into the rooms through tin flues and registers.

CHIMNEYS.

Kent gives the following:

The commonly accepted theory of chimney draught, based on Peclet's and Rankine's hypotheses (see Rankine, S. E.), is discussed by Prof. De Volson Wood in Trans. A. S. M. E., Vol. XI.

Peclet represented the law of draught by the formula

$$h = \frac{u^2}{2g} \left((1+G+\frac{f}{m}) \right)$$

in which "h" is the "head," defined as such a height of hot gases as, if added to the column of gases in the chimney, would produce the same pressure at the furnace as a column of outside air, of the same area of base, and a height equal to that of the chimney;

"u" is the required velocity of gases in the chimney;

"G" a constant to represent the resistance to the passage of air through the coal;

"l" the length of the flues and chimney;

"m" the mean hydraulic depth or the area of a cross-section divided by the perimeter;

"f" a constant depending upon the nature of the surfaces over which the gases pass, whether smooth, or sooty and rough.

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Rankine's formula (Steam Engine, p. 288), derived by giving certain values to the constants (so-called) in Peclat's formula, is

$$h = \frac{\frac{T_0}{T_2} (0.0807)}{\frac{T_0}{T_1} (0.084)} H - H \cdot (0.96 \frac{T_1}{T_2} - 1) H$$

in which H = the height of the chimney in feet;

T_0 = 493° F. absolute (temperature of melting ice);

T_1 = absolute temperature of the gases in the chimney.

T_2 = absolute temperature of the external air.

SIZES FOR CHIMNEYS.

A very essential adjunct to the working of a plant is the chimney flue, and the form of the flue has much to do with its effectiveness; thus as gases ascend in a spiral motion a round flue is the best, and a square one is better than one of rectangular shape. If of brick it should be evenly plastered. The flue should extend below the smoke pipe connection only a short distance to permit the removal of soot, if continued far below it will form an air pocket and cause down currents.

Square Feet of Direct

| Steam Radiation. | Horse Power. | Size of Chimney. | Square Feet of Direct Water Radiation. |
|------------------|--------------|------------------|--|
| 250 | 2.5 | 8"x 8"x25" | 400 |
| 500 | 5.0 | 8"x12"x30" | 850 |
| 800 | 8.0 | 12"x12"x35" | 1350 |
| 1400 | 14.0 | 12"x16"x40" | 2400 |
| 2200 | 22.0 | 16"x16"x50" | 3700 |
| 3500 | 35.0 | 18"x18"x60" | 5900 |
| 5500 | 55.0 | 20"x20"x70" | 9300 |
| 8000 | 80.0 | 24"x24"x80" | 13000 |

FORMULA FOR CALCULATING RADIATION.

The following is successfully used by a prominent member of the C. A. B. A.:

First ascertain the cubical contents, glass surface (which includes the surface of all exterior doors and windows), take into account whether N., S., E. or W.

Let "I" be the inside temperature desired, say 70° Fahrenheit, "E" the coldest exterior temperature, "V" volume of room in cubic feet, "W" exterior wall surface of room in square feet, "G" exterior windows and doors in square feet, "R" standard amount of surface radiation in square feet, "F" factor depending upon method of heating or particular story heated. When hot water overhead system is used: 4 story building, adopt 1.3 for first story, 1.2 for second, .90 for third and .60 for fourth. In 3 story buildings, 1.25 for first, 1 for second and .75 for third. For 2 story, 1.2 for first and .8 for second.

When the steam heating method is used, "F" becomes a constant equal to .8. "J" factor depending upon exposure equal to 1.4 for N., W. and N. W. exposures, equal to 1.2 for N. E. and S. W. exposures, equal to 1 for E., S. and S. E. exposures, and also for small interior courts and places well protected from north and west winds. For bathrooms where a higher temperature is usually desired J is often made 2 instead of the usual rule. Kitchens where coal ranges are used, "J" is often made as low as .5, usually .75; but where there are no coal ranges "J" should be made 1-10 less than the factor obtained for the above.

$$\left\{ \frac{V}{400} + \frac{W}{10} + \frac{G}{2} \right\} \left\{ \frac{I-E}{I} \right\} .9 = R. \quad Q \text{ equals the desired square feet direct radiation}$$

surface for a room. $Q = R F J$. "E" is usually taken as 10° higher than the minimum

recorded temperature of the locality. "I" is taken as 70°, therefore the quantity $\left\{ \frac{I-E}{I} \right\} .9$

becomes a constant for any given locality, for Chicago where the minimum temperature is minus 20° the quantity is taken at 1.03.

The diameter of all supplies in inches should not vary materially from the square root of the amount of radiation to be supplied by the pipe, divided by 100. Reduced to inches, this rule is equally applicable to the supply of a single radiator or the supply of an entire system. Good judgment must go with the use of all empirical formula, especially in the use of the factor "J," which might be called the judgment factor. Location of surrounding buildings, trees, open space, etc., should be considered in the selection of a value for "J." "W" should include area of ceiling in case of top story rooms or of rooms where the room above is not heated.

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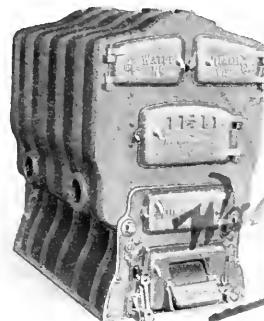
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AUTOMATIC HEAT REGULATION.

Automatic heat regulation is now recognized as a very convenient item in the equipment of modern buildings.

Its application naturally depends upon the character of the heating apparatus, it being essential in all cases that each heated apartment be supplied with at least one of the temperature controlling instruments called "thermostats," this "thermostat" regulating automatically the sources of heat supply for the apartment in which it is placed.

If the system of heating be direct radiation, the control of the radiators is accomplished by means of pneumatic diaphragm valves taking the place of the ordinary hand valves, these pneumatic valves being connected with the "thermostat." If indirect heat is used, the passage of the warm air through the heat flues is usually controlled by "mixing dampers," so arranged as to automatically mix hot and cold air in the proper proportions before it reaches the apartment, these mixing dampers being under the control of the "thermostats."

The heat regulation systems of recognized standing are generally operated by compressed air supplied by a suitable compressor in the basement, and distributed throughout the building by a system of galvanized iron and lead piping. The manufacturers of these systems invariably install the apparatus themselves, either as principal or sub-contractors, but in all cases executing to the owner a guarantee covering the operation and care of the system. The evidence seems to show that a saving of from 15 to 25 per cent in fuel consumption is accomplished in those buildings which are equipped with automatic heat regulation. This is a sufficiently large return upon the cost of the apparatus to justify its use in the majority of buildings. In residences, schools, etc., its use is imperative for hygienic reasons as well.

Specifications for temperature regulation should cover the system of piping to be installed minutely, as on the method of piping, and the size and kind of pipe used, depends, in a great measure, the success and durability of the system.

In connection with automatic control of temperature, there is also the control of the humidity of buildings, produced by artificial means. The question of humidity is a matter of great importance in buildings, and it is only since the invention of temperature regulation and the control of humidity that the device for producing humidity can be successfully installed.

Refer to File 697, Tables of Miscellaneous Information in the back part of this book for tables.

VENTILATION.

Kent gives the following:

"The popular impression that the pure air falls to the bottom of a crowded room is erroneous. There is a constant mingling of the fresh air admitted with the impure air, due to the law of diffusion of gases, to difference of temperature, etc. The process of ventilation is one of dilution of the impure air by the fresh, and a room is properly ventilated, in the opinion of the hygienists, when the dilution is such that the carbonic acid in the air does not exceed from 6 to 8 parts by volume in 10,000. Pure country air contains about 4 parts CO_2 in 10,000, and badly ventilated quarters as high as 80 parts."

An ordinary man exhales 0.6 of a cubic foot of CO_2 per hour. New York gas gives out 0.75 of a cubic ft. of CO_2 for each cubic foot of gas burned. An ordinary lamp gives out 1 cubic foot of CO_2 per hour. An ordinary candle gives out 0.3 cubic foot per hour. One ordinary gaslight equals in vivifying effect about 5½ men, an ordinary lamp 1 2-3 men, and an ordinary candle ½ man.

It is exceptional that systematic ventilation supplies the 3,000 cubic feet per inmate per hour, which adequate health considerations demand. Large auditoriums, in which the cubic space per individual is great, and in which the atmosphere is thoroughly fresh before the rooms are occupied, and the occupancy is of two or three hours' duration, the systematic air supply may be reduced, and 2000 to 2500 cubic feet per inmate per hour is a satisfactory allowance.

Hospitals, where, on account of unhealthy excretions of various kinds, the air dilution must be largest, an air supply of from 4000 to 6000 cubic feet per inmate per hour should be provided, and this is actually secured in some hospitals. A report dated March 15, 1882, by a commission appointed to examine the public schools in the District of Columbia, says:

"In each class room not less than 15 square feet of floor space should be allotted to each pupil. In each class room the window space should not be less than one-fourth the floor space, and the distance of desk most remote from the window should not be more than one and a half times the height of the top of the window from the floor. The height of the class room should never exceed 14 feet. The provisions for ventilation should be such as to provide for each person in a class room not less than 30 cubic feet of fresh air per minute (1800 per hour), which amount must be introduced and

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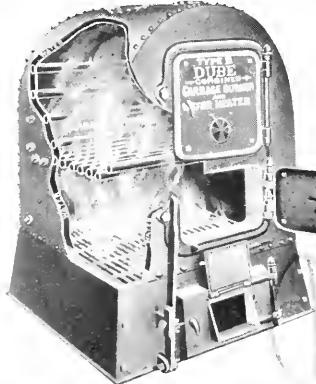
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thoroughly distributed without creating unpleasant draughts, or causing any two parts of the room to differ in temperature more than 2° F., or the maximum temperature to exceed 70° F."

When the air enters at or near the floor it is desirable that the velocity of inlet should not exceed 2 feet per second, which means larger sizes of register openings and flues than are usually obtainable, and much higher velocities of inlet than 2 feet per second are the rule in practice. The velocity of current into vent flues can safely be as high as 6 or even 10 feet per second, without being disagreeably perceptible.

The entrance of fresh air into a room is co-incident with or dependent on the removal of an equal amount of air from the room. The ordinary means of removal is the vertical vent-duct, rising to the top of the building. Sometimes reliance for the production of the current in this vent-duct is placed solely on the difference of temperature of the air in the room and that of the external atmosphere; sometimes a steam coil is placed within the flue near its bottom to heat the air within the duct; but more often exhaust fans, driven by steam or electric power, act directly as exhausters.

RULES FOR PROPORTIONING RADIATION AND MAINS.

Professor R. C. Carpenter, of Cornell University, submits the following rule for determining the size Radiator needed for a given room:

Rule: Add the area of the glass surface in the room to one-quarter of the exposed wall surface and to this add from 1/55 to 3/55 of the cubical contents (1/55 for rooms on upper floor, 2/55 for rooms on first floor and 3/55 for large halls); then for steam multiply by .25 and for hot water .40.

Example: A room $20 \times 12 \times 10$ feet with glass exposure of 48 feet, $\frac{1}{4}$ of wall exposure (two sides exposed) 320 feet $= 80$, $1/55$ of 2,400 $= 44$.

$$48 + 80 + 44 = 172 \times .25 = 43 \text{ feet.}$$

If you add $2/55$ the surface would be 54 feet.

If you add $3/55$ the surface would be 65 feet.

A rule which has been adopted by many leading heating engineers and which can be followed with confidence in proportioning radiation, is as follows:

Allow 1 sq. ft. of radiation for 2 sq. ft. of glass.

Allow 1 sq. ft. of radiation for 20 sq. ft. of exposed wall.

Allow 1 sq. ft. of radiation for 200 cu. ft. of contents.

The sum of these amounts would represent the number of feet of heating surface it would require for steam. For hot water add 70%. This is based on a temperature of 70° with the outside temperature 10° below zero.

Another rule adopted by many heating engineers is to add to the glass surface 10% of the wall surface and multiply this sum by 75 and, to this amount add the cubical contents of the room. For hot water radiation multiply this sum by .0092, for steam by .0055.

This is based on a temperature of 70° with the temperature outside at zero. In localities where the temperature falls below zero, add to the amount of radiation obtained, 1% for every degree below zero.

TABLE OF EQUIVALENT TEMPERATURE FOR TESTING A HEATING PLANT AT DIFFERENT OUTSIDE TEMPERATURES.

For the purpose of indicating the efficiency of the apparatus for any specified condition, Prof. Carpenter gives the following table, which has been generally accepted as the standard test.

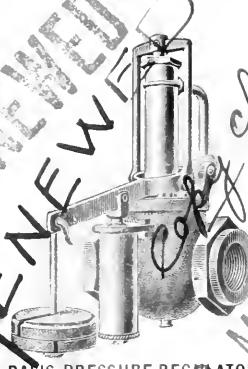
For steam, the Radiator temperature in all cases is assumed to be that due to a pressure of 3 lbs. at the boiler, or about 220° Fahr.

For water, the Radiator temperature is assumed in all cases to be at an average or 160° Fahr.

For a plant proportioned sufficiently to maintain a temperature of 70° when the outside temperature is at zero.

| Temperature of Outside Air | Room should be raised to | Temperature of Outside air | Room should be raised to |
|----------------------------|--------------------------|----------------------------|--------------------------|
| 10 | 64.7 | 50 | 98.7 |
| 0 | 70.0 | 60 | 104.7 |
| 10 | 75.1 | 70 | 110.5 |
| 20 | 81.0 | 80 | 117.1 |
| 30 | 86.5 | 90 | 123.5 |
| 40 | 93.1 | 100 | 130.3 |

See University of Illinois Engineering Experiment Station Bulletin No. 31 for methods and results of tests on house heating apparatus. These tests have been made on different kinds of house heating apparatus with different kinds of fuel. The bulletin embodies the results of about three hundred tests. These bulletins are for free distribution.



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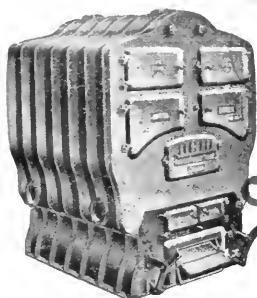
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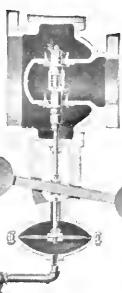


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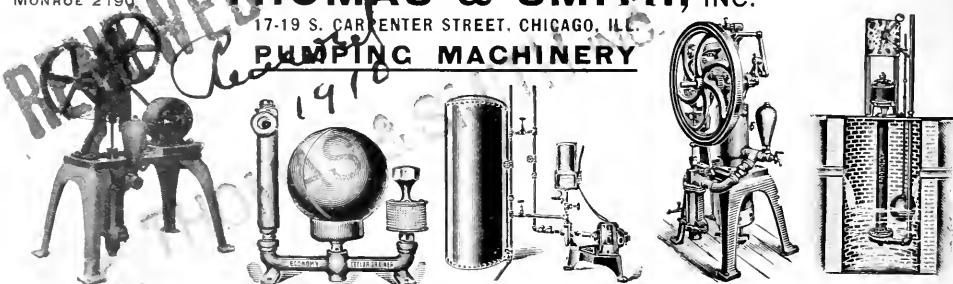
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EXPANSION AND CONTRACTION.

Scarcely anything can withstand the expansion of iron. It expands from 23° to 212°, about 1/900 of its length, which in 100 feet equals 1½ inches. The expanding power of a 2-inch pipe when heated to a temperature of 100 pounds steam, or to 338°, exerts a force sufficient to move 25 tons.

Cast iron expands 1/162000 of its length for each degree Fahr. it is subjected to within ordinary limits while in its solid state.

Wrought iron expands 1/150000 of its length for each degree Fahr. To find the expansion of a line of pipe, multiply its length in inches by the number of degrees of temperature applied and divide the product by 150,000 for required expansion in inches; thus $100' \times 12'' = 1200 \times 338'' = 405600 \div 150000 = 2.7$ inches.

Special attention, then, must be given to the expansion and contraction of pipes and allowance made for it. Pipes and branches must be unconfined, especially in the direction of their length.

Expansion joints should not be used if the expansion can be compensated for in any other way.

RADIATION OF HEAT.

Radiation of heat takes place between bodies at all distances apart, and follows the laws for the radiation of light.

The heat rays proceed in straight lines, and the intensity of the rays radiated from any one source varies inversely as the square of their distance from the source.

This statement has been erroneously interpreted by some writers, who have assumed from it that a boiler placed two feet above a fire would receive by radiation only one-fourth as much heat as if it were only one foot above. In the case of boiler furnaces the side walls reflect those rays that are received at an angle—following the law of optics, that the angle of incidence is equal to the angle of reflection,—with the result that the intensity of heat two feet above the fire is practically the same as at one foot above, instead of only one-fourth as much.

The rate at which a hotter body radiates heat, and a colder body absorbs heat, depends upon the state of the surfaces of the bodies as well as on their temperatures. The rate of radiation and of absorption are increased by darkness and roughness of the surfaces of the bodies, and diminished by smoothness and polish. For this reason the covering of steam pipes and boilers should be smooth and of a light color: uncovered pipes and steam-cylinder covers should be polished.

The quantity of heat radiated by a body is also a measure of its heat-absorbing power, under the same circumstances. When a polished body is struck by a ray of heat, it absorbs part of the heat and reflects the rest. The reflecting power of a body is therefore the complement of its absorbing power, which latter is the same as its radiating power.

The relative radiating and reflecting power of different bodies has been determined by experiment, but as far as quantities of heat are concerned, says Prof. Trowbridge (Johnson's Cyclopaedia, art. Heat), it is doubtful whether anything further than the said relative determinations can, in the present state of our knowledge, be depended upon, the actual or absolute quantities for different temperatures being still uncertain. The authorities do not even agree on the relative radiating powers.

HEATING BY ELECTRICITY.

If the electric currents are generated by a dynamo driven by a steam engine, electric heating will prove very expensive, since the steam engine wastes in the exhaust steam and by radiation about 90 per cent of the heat units supplied to it. In direct steam heating, with a good boiler and properly covered supply pipes, we can utilize about 60 per cent of the total heat value of the fuel. One pound of coal, with a heating value of 13,000 heat units, would supply to the radiators about $13,000 \times .60 = 7800$ heat units. In electric heating, suppose we have a first class condensing engine developing 1 H. P. for every 2 lbs. of coal burned per hour. This would be equivalent to $1,980,000 \text{ ft.-lbs.} \div 778 = 2545$ heat units, or 1272 heat units for 1 lb. of coal. The friction of the engine and of the dynamo and the loss by electric leakage, and by heat radiation from the conducting wires, might reduce the heat units delivered as electric current to the electric radiator, and these converted into heat to 50 per cent of this, or only 636 heat units, or less than one-twelfth of that delivered to the steam radiators in direct steam heating. Electric heating, therefore, will prove uneconomical unless the electric current is derived from water or wind power, which would otherwise be wasted.



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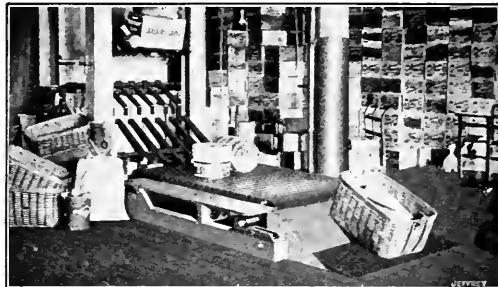
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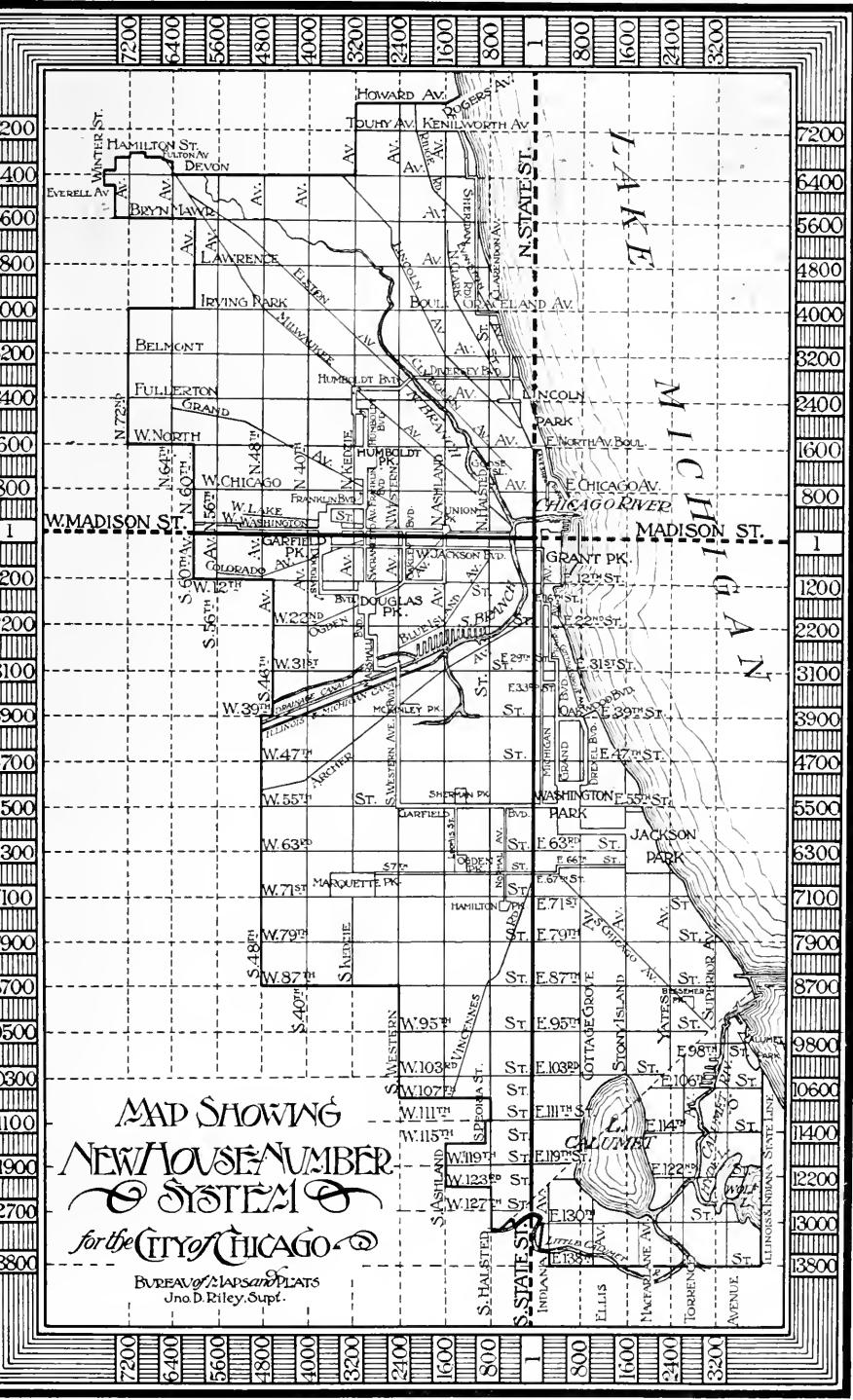
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POINTS ON VARNISH.

BY HERMAN ROSENBERG

Drying and Hardening.—Proper light and ventilation are absolutely necessary to facilitate drying and hardening. Varnish applied in buildings that are damp and not properly heated in cold weather, will be considerably retarded in drying and hardening. Extremely hot weather will also keep varnish soft for quite a time. The best results are obtained at a temperature of 70 to 75 degrees Fahrenheit.

Turning White.—It is caused by the action of water and dampness. The more elastic the varnish, the better it will resist this action, whereas, cheap, brittle, quick-drying varnishes are very easily affected.

Brittleness.—Is an inherent defect in the varnish caused by an excess of dryer, lack of oil, or by adulterated materials having been used in its manufacture. If a varnish powders white under friction of the finger or easily scratches white, that is incontrovertible evidence of its poor quality. Brittle varnishes should not be used even for the undercoats, as they destroy the toughness and durability of the finish, despite its being protected with an elastic, durable finishing varnish. It is poor economy, in any event, to use brittle varnishes, as the cost of application, which is the main expense, is the same as if good material were employed.

Chilling.—As its name implies, is caused by exposure to cold weather. Varnish should never be used while in this condition. To remedy is to keep the chilled varnish in a warm room, until it has been restored to its normal condition. Long exposure to cold weather may also cause the varnish to become "specky" and "seedy," in which event it is necessary to keep it near a steam pipe or warm stove for some time, until the chilled particles have disappeared.

Cracking.—Cracking is caused by the under coats not having been dry when the finishing coat was applied, or when abnormally heavy coats have been used, especially for the undercoats. Brittle varnishes are liable to crack when exposed to sudden changes of temperature.

Blooming or Going Foggy.—Is caused by exposure to dampness, moisture or gases, after the varnish has become hard. The more elastic the varnish, the less liable it is to "bloom" or become "foggy."

Wrinkling, Crawling, Cramping or Sagging.—Is caused by applying the varnish too heavily or by exposure to sudden changes of temperature while in the process of drying, or if the undercoats are not dry when the finishing coat is applied.

Deadening or Sinking Away.—Caused by the undercoats not having been allowed sufficient time to dry, causing the finishing coat to become absorbed while in the course of hardening. Insufficient foundation coats will also cause the finishing to sink away.

Blistering.—Is caused by the action of heat, especially from the concentrated rays of the sun, if sap or dampness is retained in the wood, or if moisture exists in the undercoats when the finishing coat is applied.

Pitting.—Is caused by applying varnish over an oily or damp surface; also, if the varnisher is not careful to thoroughly incorporate the turpentine in reducing the varnish, or uses improper thinning material.

Knots and Sappy Woods.—The sap and knots should be "killed" by the use of grain or wood alcohol shellac for the first coat. If this is not done, the sap will work through and injure the finish.

Thinning.—When found necessary, should be done with spirits of turpentine. In order to insure proper amalgamation, neither the varnish nor the turpentine should be too cold when mixing. The warmer the varnish and turpentine, the quicker the amalgamation. After reducing the varnish, allow it to stand awhile before using. Oil, Japan or liquid dryer should **never** be added to varnish.

SWEATING.—Is caused by rubbing the undercoat before it is thoroughly dry.

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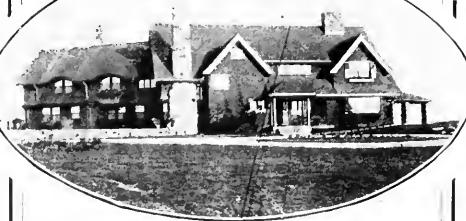
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WOOD FINISHING.

BY FRANKLIN MURPHY, JR.

How should wood be finished? It depends upon the kind of wood and the final purpose of the finishing. Ordinary soft wood can be painted, and it will look well as long as the paint remains sound. It may be stained and varnished, and if the varnish is good it will look well almost as long as the house lasts.

Let us look for a moment at the wood itself. It may be open grained like oak, or close grained like maple or pine. If it is to be stained there are two distinct ways of doing it. The ordinary way is to put a colored stain on the wood, which will make the wood about the color of the stain. That is the old fashioned, obvious way, and it colors wood very much the same way that a very thin coat of paint would. It is bound to cloud the grain. The other way is to put on a chemical stain adapted to the chemical nature of the sap and fibre, and the reaction will change the color of the wood without leaving anything on the surface; the grain will be developed instead of clouded.

Chemical stains are acids or alkalies, depending upon the wood to be treated and the shade desired, and a certain stain may give widely different effects on different woods because of the difference in the chemical nature of the woods.

Once the proper shade is obtained the wood is ready for further treatment. There are lots of ways of proceeding. Some people rub boiled oil into the wood; some finish entirely with shellac; some finish with French polish, which is a method of rubbing a solution of shellac into the grain of the wood; some apply wax; some put on varnish, using paste filler or not, as the circumstances demand. The latter method is that most commonly used in this country.

Suppose we discuss oak. The ordinary oak trim is very pale yellow in color and is almost never finished without a stain of some kind. In the opinion of the writer, most people do not appreciate how beautiful oak is if finished without stain. It is infinitely finer in its natural color than it is when the pores are filled with a black or a muddy dark brown stain. After staining, the pores of the wood must be filled, because there are open spaces which would make varnish look very uneven without the filler.

Filler is made of powdered silex ground up in some vehicle which will bind it, and dry, so that it will hold it. The result is that the pores of the wood are filled with this powder and the grain is clouded to just that extent. The filler is toned to match the stain, and after it is dry it is sandpapered down so that a smooth surface is ready for the varnish. Sometimes a coat of shellac is given to make a good hard surface, but shellac is brittle, and, while it holds out the varnish and causes it to show a very full, rich appearance, it interferes with the hold of the varnish on the wood. If it is used at all, it should be used very thin and sandpapered.

Oak and all other open grained woods are prepared in this way for finishing with shellac, wax or varnish. If varnish is used, two or three coats should be applied, with sufficient time between coats to allow of drying; and after that is done there is a still further option. The varnish may be left as it dries. It would then have a sharp, uneven gloss, due to irregularities in the wood and brush marks, and the little specks of dust which are bound to be caught. It is not the best finish for appearance, but it is distinctly the best for durability, and for the service parts of a house it will give the greatest satisfaction if left in that condition. Perhaps it lasts longer because none is rubbed off; that is, there is a thicker film of varnish. It has always been an idea of the writer, however, that when the finish was rubbed down the surface was broken and there was more opportunity for moisture and vapors to enter into the varnish and attack its life. If this gloss finish is not desired, the work may be rubbed. This is done with fine pumice stone and water applied with a piece of felt, being rubbed hard until the work is brought to a smooth, level surface. The result is a finish almost without lustre. If a slight lustre is wanted, a further rubbing with crude oil and pumice powder will produce it. If a polish is desired, it should be further rubbed with rotten stone and oil, and perhaps finally with a polishing liquid.

The individual ability of painters to secure a high polish varies with the amount of skill each one possesses. It is interesting to note at this point that a painter will apply slightly more than one gallon of varnish in a day—never as much as two gallons—on the trim of a house. It will take him longer to rub it than it did to put it on, so it might be said that the cost of varnishing a house is one part material; two parts labor of application, because the painter's time for one day is about equal to the cost of two gallons of the best house varnish, and four parts labor of rubbing.

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Shellac is a very popular material because it dries quickly. It does not cost quite as much as the finest oil varnish, and it is more expensive to put on because it brushes harder. It has the disadvantage of turning white under moisture, and the curious fact is that shellac will turn white even though two or three coats of varnish are put over it. That phenomenon has never been explained satisfactorily. Shellac may be rubbed just as varnish is, and if white shellac is used it may be put over delicate colored woods without affecting their color to any extent.

There is a new kind of material which has recently been put on the market in order to save the expense of rubbing, and yet present the same general appearance. The preparations for this purpose are applied over the final coat of varnish and they dry with a very flat appearance. It is not very beautiful, although it is perhaps better than the bright glare of the final varnish coat. Many of these preparations are very tender and can be scratched off with the finger nail. That is usually the indication of wax, and, although wax may be a very good finishing material when used all the way through, it is very bad indeed when used over varnish or mixed with varnish.

The foregoing are a few facts about the way wood is finished in house work. Each painter is apt to have slight changes in the methods he uses and it is, as a rule, best to let him have his way where the result is the important thing, but there are a few points on which no painter should be allowed leeway:

1. Never permit his advice on the choice of material. It may be safe sometimes, but the chance is so small that you can neglect it.
2. Never permit him to use shellac under varnish on floors or where moisture is apt to come in contact with the varnish.
3. Never permit him to use wax in varnish. A little mixed in the finishing coat makes it much easier to rub, and you will not know the difference until long after the bill is paid, but you will know it, or your client will.

TIME—AN IMPORTANT FACTOR IN PAINTING.

Extracts from a paper read before the Chicago Architects' Business Association.

By P. WILLIAM NELSON.

Late Professor at the Royal Polytechnicum, the Royal Industrial High School and School of Technology at Stockholm, Sweden; also Instructor of Decorative Art at the Pratt Institute, Brooklyn, N. Y.

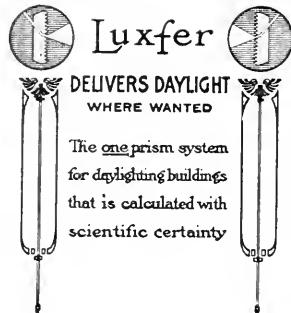
In these days of rush and push, when everything has to be completed with undue haste and often within a time not consistent with good workmanship and durability of work, it is perhaps appropriate to raise a voice of warning against the consequences or at least to point out what effect this frantic rush will have on the work of the painter. No man connected with the building trade is more dependent upon time than the painter, and hardly anyone is rushed as much as he is. In speaking of rush I am not alluding to the great haste which often becomes necessary in the construction and painting of exposition buildings, decorations for celebrations and work of that kind, as this is merely temporary work where any means which will bring desired results must, of course, be permitted, but I am speaking of the unwholesome, frantic rush with which work is done in the very best of our modern buildings, built to last for centuries.

For good work it is necessary that the surface to be painted is dry, not only on the outer surface, but dry all through. This is a fact which is recognized by all who are familiar with the nature and workings of oil paint. In our modern buildings, however, the painter, in a large number of cases, I dare say more than 90 per cent, is at work long before the walls are half dry. Should the painter, in such cases, be lucky enough to succeed, through the use of special materials, working methods and tricks, in producing a

temporary well looking job, which will pass inspection, it will not take long for the consequences to manifest themselves.

The effect is varying in accordance with the difference in nature of the surfaces painted. In drying, the moisture in the wall is forced against the paint, and if it is only plain moisture the result is generally that the paint blisters or peels; but if the moisture contains alkalies or salts in dissolved state, it may further be discoloration or checking, or the paint may become so soft that it runs down the wall from some more affected spots. Concrete and Keen's Cement, so much used in our modern buildings, dry slower than any other building material, and should, therefore, be given more time in which to dry before painting is attempted. Not only does time play an important part before the work is commenced, as it is just as important a factor while the work is going on. Linseed oil, which, as is well known, constitutes the binder in all good oil paint, dries by oxidation, a fact which is also well known. The linseed oil in its raw state dries very slow. The oxidation is hastened by adding to the oil such ingredients which will act as agents between the oil and the oxygen of the air. This adding process was in olden times accomplished only by boiling the oil together with the proper amount of such ingredients for two or more hours. This is today called Kettle Boiled Oil, but, I am sorry to say, very little of it is used. The ordinary boiled

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linseed oil on the market is an altogether different product from the Kettle Boiled Oil, and very much inferior. By far the largest amount of painting is today done with the use of raw linseed oil, to which is added liquid driers (a product derived mostly from the same ingredients which were formerly used in the boiling of the oil), a practice never thought of at the time of my apprenticeship. By the use of properly boiled oil it can always be ascertained beforehand how soon the paint will dry, provided, however, that no pigments are used, which will hasten or retard the oxidation, but with the use of raw linseed oil and driers it is all guess work. Too much driers in a paint is dangerous. It is possible to add so much driers that the paint will never dry. It will set very quickly and may permit another coat to be applied over it, but it never dries firm. I have in my house a surface painted over a year ago with a paint made from raw linseed oil and too much driers, and it is tacky today.

After the paint has been applied to a surface it must be given sufficient time to oxidize or dry before the following coat is applied. If the coat of paint is too heavy, or, in other words, if the paint has been applied too liberally, it may take weeks and even longer before the oxygen can penetrate through. The paint will dry on the surface only, and be tacky or sticky underneath. If such tacky coating is followed by one or more coats which dry perfectly hard, the surface will check or crack in due time. This checking is often seen on graining when the varnish has been applied before the paint underneath has had time to dry.

A flat paint applied over such tacky coating will, after a short while, present a surface which is flat in some places and glossy in others. In order to satisfy this demand for haste, and, I have to admit, sometimes for less honorable reasons, the painter will resort to size, the use of which has come more into vogue than is good for our buildings. Under no conditions should size of any kind be permitted on the bare plaster as a preparation for oil paint, if good work is expected. Varnish size is mostly used, but sometimes no hesitation is shown to the use of glue size. If a varnish size is applied to the bare plaster it does not penetrate into the body of the wall, but stays right on the surface, and gets no real hold of the wall itself. The result is that after the paint has dried hard it will chip off the wall very easily, provided, however, that the varnish has dried perfectly hard; and, if it has not, the paint will check or crack. When a coat of glue size is used on the bare wall, the paint invariably peels and flakes off. For cheap work a coat of thin glue size may be permitted between the priming coat and the next coat, but never on the bare plaster.

We often hear people say that we cannot do as good and durable work today as was done in older days, and therewith insinuating that the painter has either not the knowledge or else not the material necessary. This is a false accusation. It is true that very rarely is such durable work done. It is also true that the knowledge of a large number of painters is very limited, and that the market is flooded with fraudulent materials, but for all this the dear public is responsible. We have today painting materials which in quality are far ahead of anything our grandfathers ever dreamed of, and it would be an insult to the intelligence of our paint chemists to think that we should not have advanced along this line as well as others, but the volume used of this grade of goods is indeed very small compared with the avalanche of the

other kind. In order to produce first class work of painting, the surface must first of all be in proper condition to receive the paint. It must be clean and dry. If the surface is smoky or greasy, it should be washed clean with a soda solution, and some surfaces may even need to be washed with an acid solution in order to insure durable work. The idea that the suction in the wall should be stopped with some kind of preparation is absolutely wrong. The suction is needed to give the paint a good hold of the wall. The further the paint penetrates into the wall the more durable becomes the work, if properly executed. The wall should be fed with linseed oil paint until the desired appearance of the surface is obtained. Should the suction, however, be too excessive, caused either by unsuitable building materials or poor workmanship on the part of the plasterer, it may be expedient to use a coat of thin glue size between the coats.

The priming coat should be used fairly thin. The harder the surface to be painted the more turpentine is needed in the paint to enable the oil to penetrate well into the wall. Driers, and of that only the very best, should be used very sparingly and several days must be allowed for the priming coat to dry. No fixed time can be set, because the oxidation or drying of the oil depends upon several things, such as the amount of driers in the paint, the condition of the atmosphere, etc., but sufficient time must be given for the coating to become firm. In damp and humid weather the drying is considerably slower than in clear weather. A free circulation of fresh, dry air will hasten the oxidation considerably.

The second coat may be mixed a little heavier. The paint should be brushed out well on the wall, leaving but a thin coating which can easily be penetrated by the oxygen of the air, and in consequence dry within a short time, when the wall will be ready for a third coat. It is the thorough oxidation of each coat which makes the paint durable. The aim today seems to be to load the paint on the wall as heavily as can be done, and to cover with the least number of coats in the shortest time possible. The result is that there is left on the wall a heavy, mushy coating, which may appear dry on the outer surface, but is soft underneath and which will never dry properly. Such work cannot be lasting. The walls are, of course, not subjected to the same wear and tear as are floors, woodwork, etc., where the paint will wear off in a very short time, but even so the surface has but very little resistance, and is very easily marred by spots and marks, and if rich in oil, i. e., glossy, will soon turn the color brownish with a greasy appearance.

No first class work can be done on the bare wall because the lime in the wall will destroy most of the colors used for tinting the calcimine. This necessitates a size which will prevent the lime from eating through. Such size to be safe for all colors must either be a varnish, shellac or paint and this cannot be applied before the wall is dry. The size must be given time to dry hard or else the calcimine will crack. The most practical size, as a preparation for calcimine, is undoubtedly a suitable varnish, properly thinned down, and to which powdered pumicestone, zinc, etc., has been added for smooth walls, but if the calcimine is only to be a temporary coating, and the intention is to paint with oil paint in the future, the varnish is dangerous, as it cannot easily be removed, and it is a very poor foundation for the oil paint. In such cases, flat oil paint, as a size, is to be preferred, even if it should be necessary to give two coats to check the lime.



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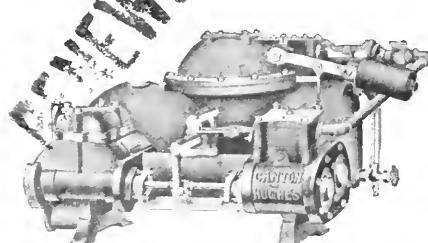
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Breadth-of-the-beam times **the-square-of-the-depth** divided by six equals **Bending-Moment** divided by **allowable-working-strength** per unit of area corresponding with unit of length used for stating the length and breadth of beam.

Bending-Moment (for beams uniformly loaded) equals **weight-to-be-supported-per-unit-of-length** times **the-square-of-the-total-number-of-units-of-length** divided by eight.

For a simple beam loaded with a single weight, the **maximum-Bending-Moment** (which is to be used in formula) equals **the-entire-load** times **[the-length-of-the-beam] minus [the-distance-of-the-load-from-the-left-hand-end]** times **the-distance-of-the-load-from-the-left-hand-end-of-the-beam** divided by **the-length-of-the-beam**.

If the load be movable **the-distance-of-load-from-left-hand-end** will be variable and the **maximum-moment** will be developed when the load is at the middle where the **maximum-Bending-Moment** is equal to **one-fourth-the-load** times **the-length-of-the-beam**. Placing the entire load on a beam at its center therefore produces the maximum strain that it is possible to produce on such beam by any position of such load.

APPLICATION OF ABOVE PRINCIPLES.

M=maximum bending moment.

S=the tensile or compressive unit stress per square inch allowable by building code or engineering practice for the material selected (See Section 595, Chicago Municipal Code).

l=length in inches of beam between supports.

b=breadth in inches of the beam.

d=depth in inches of the beam.

w=weight in pounds on beam including the weight of the beam itself per each inch of length.

W=total weight in pounds on beam=**l w**.

FOR UNIFORM LOADING.

$$b = \frac{3 w l^2}{4 d^2 S} = \frac{3 W l}{4 d^2 S} = \text{breadth of beam.} \quad d = \sqrt{\frac{3 w l^2}{4 b S}} = \sqrt{\frac{3 W l}{4 b S}} = \text{depth of beam.}$$

To find **b** it is necessary to assume a value for **d**. Also to find **d** it is necessary to assume a value for **b**. In case it is found that the value by formula is too large or too small for practical use, then assumed value must be changed so as to bring the computed value to a practical size.

Table of greatest center loads for horizontal rectangular beams of white or yellow pine, or of spruce, 1 inch broad, supported at both ends, and required not to bend more than $\frac{1}{40}$ inch per foot of clear span, or $\frac{1}{80}$ part of the entire clear span. In practice, to allow for knots, etc., take only $\frac{2}{3}$ reds.

This table was calculated with constant .000325, instead of .00032, the loads in this table include the weight of the clear beam itself; .625 of which (or $\frac{1}{2}$ of which) must be deducted from the tabular loads to get the neat load, when the beam is loaded at its center. When uniformly loaded, the loads will be 1.6 times as great as those in this table; but in that case the weight of the entire clear beam must be deducted. In practice this deduction need rarely be made.

CLEAR SPANS IN FEET. (TRAUTWINE)

| Depth in Inches. | CLEAR SPANS IN FEET. | | | | | | | | | | Wt. of 10 ft. Length of beam. lbs. | | | | | | |
|------------------------|----------------------|------|------|------|------|------|------|------|------|------|--|------|------|------|------|------|------|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 14 | 16 | 18 | 20 | 25 | 30 | 35 | 40 |
| lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. |
| 1 | 8.4 | 4.8 | 3.0 | 2.1 | 1.6 | 1.1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 2 | 28.7 | 16.2 | 10.4 | 7.2 | 5.3 | 3.6 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 3 | 68.4 | 38.4 | 21.4 | 17.1 | 12.4 | 9.6 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 4 | 130 | 75 | 48 | 33 | 24 | 19 | 14 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 5 | 131 | 92 | 58 | 42 | 32 | 26 | 21 | 16 | 12 | 10 | 8 | 6 | 5 | 4 | 3 | 2 | 1 |
| 6 | 196 | 137 | 100 | 77 | 60 | 49 | 34 | 25 | 20 | 16 | 12 | 10 | 8 | 7 | 6 | 5 | 4 |
| 7 | 267 | 192 | 144 | 108 | 86 | 70 | 48 | 36 | 27 | 20 | 16 | 12 | 10 | 9 | 8 | 7 | 6 |
| 8 | 336 | 260 | 196 | 150 | 116 | 96 | 66 | 49 | 37 | 29 | 22 | 17 | 14 | 12 | 11 | 10 | 9 |
| 9 | 405 | 329 | 259 | 204 | 166 | 128 | 89 | 65 | 50 | 39 | 32 | 26 | 20 | 17 | 15 | 14 | 13 |
| 10 | 474 | 352 | 287 | 207 | 183 | 143 | 102 | 81 | 66 | 52 | 41 | 33 | 23 | 21 | 19 | 17 | 16 |
| 11 | 543 | 412 | 324 | 263 | 225 | 183 | 144 | 102 | 81 | 66 | 52 | 41 | 33 | 23 | 21 | 19 | 18 |
| 12 | 611 | 403 | 324 | 263 | 225 | 183 | 144 | 102 | 81 | 66 | 52 | 41 | 33 | 23 | 21 | 19 | 18 |
| 13 | 680 | 484 | 394 | 324 | 273 | 210 | 164 | 121 | 98 | 73 | 54 | 44 | 32 | 24 | 21 | 19 | 18 |
| 14 | 749 | 685 | 475 | 350 | 211 | 184 | 145 | 117 | 74 | 52 | 38 | 29 | 21 | 17 | 15 | 14 | 13 |
| 15 | 818 | 692 | 560 | 389 | 256 | 219 | 173 | 140 | 90 | 62 | 45 | 35 | 26 | 20 | 18 | 17 | 16 |
| 16 | 887 | 662 | 460 | 336 | 237 | 202 | 164 | 104 | 72 | 52 | 40 | 35 | 26 | 20 | 18 | 17 | 16 |
| 17 | 956 | 769 | 634 | 392 | 237 | 200 | 164 | 104 | 72 | 52 | 40 | 35 | 26 | 20 | 18 | 17 | 16 |
| 18 | 1025 | 769 | 619 | 454 | 348 | 271 | 221 | 141 | 98 | 63 | 44 | 32 | 24 | 21 | 19 | 18 | 17 |
| 19 | 1094 | 769 | 711 | 522 | 309 | 316 | 236 | 163 | 114 | 83 | 64 | 44 | 32 | 24 | 21 | 19 | 18 |
| 20 | 1163 | 813 | 597 | 436 | 361 | 291 | 185 | 129 | 93 | 64 | 44 | 32 | 24 | 21 | 19 | 18 | 17 |
| 21 | 1232 | 923 | 678 | 519 | 410 | 332 | 212 | 148 | 108 | 83 | 63 | 44 | 32 | 24 | 21 | 19 | 18 |
| 22 | 1301 | 1075 | 874 | 619 | 528 | 420 | 273 | 188 | 138 | 105 | 83 | 63 | 44 | 32 | 24 | 21 | 19 |
| 23 | 1369 | 1075 | 823 | 651 | 527 | 337 | 234 | 172 | 132 | 105 | 83 | 63 | 44 | 32 | 24 | 21 | 19 |
| 24 | 1438 | 1075 | 1000 | 801 | 652 | 411 | 290 | 212 | 162 | 132 | 105 | 83 | 63 | 44 | 32 | 24 | 21 |
| 25 | 1503 | 1230 | 971 | 787 | 564 | 350 | 257 | 197 | 162 | 132 | 105 | 83 | 63 | 44 | 32 | 24 | 21 |
| 26 | 1568 | 1175 | 944 | 604 | 420 | 309 | 236 | 176 | 146 | 116 | 86 | 66 | 46 | 34 | 26 | 24 | 22 |
| 27 | 1635 | 1121 | 717 | 498 | 365 | 309 | 236 | 176 | 146 | 116 | 86 | 66 | 46 | 34 | 26 | 24 | 22 |
| 28 | 1676 | 1385 | 1175 | 717 | 498 | 365 | 236 | 176 | 146 | 116 | 86 | 66 | 46 | 34 | 26 | 24 | 22 |
| 29 | 1744 | 1538 | 1385 | 1175 | 944 | 604 | 420 | 309 | 236 | 176 | 146 | 116 | 86 | 66 | 46 | 34 | 26 |
| 30 | 1816 | 1761 | 1761 | 1761 | 1761 | 1761 | 1761 | 1761 | 1761 | 1761 | 1761 | 1761 | 1761 | 1761 | 1761 | 1761 | 1761 |

On this side of the dark lines, the safe loads of table would not bend the wooden beams as much as $\frac{1}{80}$ of their clear span.

Iron and Steel.

Average cast iron, with safe def. will bear about 11 $\frac{1}{2}$ as much as common yellow or white pine, or spruce; and wrought iron 19 times as much. The same proportion of the weight of the beam itself must, however, be deducted as stated above for wood. Average steel 29 times as much as pine.

IMPORTANT.—When load is uniformly distributed over beam take 1.6 times above loads.

TABLES OF SAFE LOADS FOR RECTANGULAR AND CYLINDRICAL COLUMNS.

FILE 690.12

Safe Loads in Tons of 2,000 Lbs. for Hollow Rectangular Cast Iron Columns.

Chicago Municipal Code, Sec. 593.—No cast iron column shall have a length to exceed 24 times its diameter or least side.

Safe Loads in Tons of 2,000 Lbs. for Hollow Cylindrical Cast Iron Columns

| Length in Feet | 9 INCH DIAMETER. | | | | | | | | | | 10 INCH DIAMETER. | | | | | | | | | | 11 INCH DIAMETER. | | | | | | | | | | Length in Feet |
|----------------|-------------------------------|-----|-----|-----|-----|-------------------------------|-----|-----|-----|-----|-------------------------------|-----|-----|-----|----|-------------------------------|-----|-----|-----|-----|-------------------------------|-----|-----|-----|-----|-------------------------------|-----|-----|-----|-----|----------------|
| | Thickness of Metal in Inches. | | | | | Thickness of Metal in Inches. | | | | | Thickness of Metal in Inches. | | | | | Thickness of Metal in Inches. | | | | | Thickness of Metal in Inches. | | | | | Thickness of Metal in Inches. | | | | | |
| | 2 | 3 | 4 | 5 | 6 | 2 | 3 | 4 | 5 | 6 | 2 | 3 | 4 | 5 | 6 | 2 | 3 | 4 | 5 | 6 | 2 | 3 | 4 | 5 | 6 | 2 | 3 | 4 | 5 | 6 | |
| 83 | 93 | 103 | 113 | 123 | 133 | 67 | 78 | 81 | 92 | 104 | 124 | 134 | 150 | 173 | 9 | 105 | 117 | 125 | 133 | 153 | 174 | 191 | 205 | 225 | 246 | 271 | 291 | 304 | 310 | 319 | 328 |
| 84 | 94 | 104 | 114 | 124 | 134 | 68 | 79 | 82 | 93 | 105 | 125 | 135 | 151 | 174 | 10 | 116 | 127 | 138 | 146 | 161 | 181 | 198 | 210 | 230 | 250 | 271 | 291 | 307 | 314 | 323 | 332 |
| 85 | 95 | 105 | 115 | 125 | 135 | 69 | 80 | 83 | 94 | 106 | 126 | 136 | 152 | 175 | 11 | 117 | 128 | 139 | 147 | 162 | 182 | 199 | 211 | 231 | 251 | 272 | 292 | 308 | 315 | 324 | 333 |
| 86 | 96 | 106 | 116 | 126 | 136 | 70 | 81 | 84 | 95 | 107 | 127 | 137 | 153 | 176 | 12 | 118 | 129 | 140 | 148 | 163 | 183 | 200 | 212 | 232 | 252 | 273 | 293 | 309 | 316 | 325 | 334 |
| 87 | 97 | 107 | 117 | 127 | 137 | 71 | 82 | 85 | 96 | 108 | 128 | 138 | 154 | 177 | 13 | 124 | 135 | 146 | 154 | 169 | 189 | 206 | 226 | 246 | 267 | 287 | 307 | 323 | 332 | 341 | 350 |
| 88 | 98 | 108 | 118 | 128 | 138 | 72 | 83 | 86 | 97 | 109 | 129 | 139 | 155 | 178 | 14 | 125 | 136 | 147 | 155 | 170 | 190 | 207 | 227 | 247 | 267 | 287 | 307 | 323 | 332 | 341 | 350 |
| 89 | 99 | 109 | 119 | 129 | 139 | 73 | 84 | 87 | 98 | 110 | 130 | 140 | 156 | 180 | 15 | 126 | 137 | 148 | 156 | 171 | 191 | 208 | 228 | 248 | 268 | 288 | 308 | 324 | 333 | 342 | 351 |
| 90 | 100 | 110 | 120 | 130 | 140 | 74 | 85 | 88 | 99 | 111 | 131 | 141 | 157 | 181 | 16 | 127 | 138 | 149 | 157 | 172 | 192 | 210 | 230 | 250 | 270 | 290 | 310 | 326 | 335 | 344 | 353 |
| 91 | 101 | 111 | 121 | 131 | 141 | 75 | 86 | 89 | 100 | 112 | 132 | 142 | 158 | 182 | 17 | 128 | 139 | 150 | 158 | 173 | 193 | 211 | 231 | 251 | 271 | 291 | 311 | 327 | 336 | 345 | 354 |
| 92 | 102 | 112 | 122 | 132 | 142 | 76 | 87 | 90 | 101 | 113 | 133 | 143 | 159 | 183 | 18 | 129 | 140 | 151 | 159 | 174 | 194 | 212 | 232 | 252 | 272 | 292 | 312 | 328 | 337 | 346 | 355 |
| 93 | 103 | 113 | 123 | 133 | 143 | 77 | 88 | 91 | 102 | 114 | 134 | 144 | 160 | 184 | 19 | 130 | 141 | 152 | 160 | 175 | 195 | 213 | 233 | 253 | 273 | 293 | 313 | 329 | 338 | 347 | 356 |
| 94 | 104 | 114 | 124 | 134 | 144 | 78 | 89 | 92 | 103 | 115 | 135 | 145 | 161 | 185 | 20 | 131 | 142 | 153 | 161 | 176 | 196 | 214 | 234 | 254 | 274 | 294 | 314 | 330 | 339 | 348 | 357 |
| 95 | 105 | 115 | 125 | 135 | 145 | 79 | 90 | 93 | 104 | 116 | 136 | 146 | 162 | 186 | 21 | 132 | 143 | 154 | 162 | 177 | 197 | 215 | 235 | 255 | 275 | 295 | 315 | 331 | 340 | 349 | 358 |
| 96 | 106 | 116 | 126 | 136 | 146 | 80 | 91 | 94 | 105 | 117 | 137 | 147 | 163 | 187 | 22 | 133 | 144 | 155 | 163 | 178 | 198 | 216 | 236 | 256 | 276 | 296 | 316 | 332 | 341 | 350 | 359 |
| 97 | 107 | 117 | 127 | 137 | 147 | 81 | 92 | 95 | 106 | 118 | 138 | 148 | 164 | 188 | 23 | 134 | 145 | 156 | 164 | 179 | 199 | 217 | 237 | 257 | 277 | 297 | 317 | 333 | 342 | 351 | 360 |
| 98 | 108 | 118 | 128 | 138 | 148 | 82 | 93 | 96 | 107 | 119 | 139 | 149 | 165 | 190 | 24 | 135 | 146 | 157 | 165 | 180 | 200 | 218 | 238 | 258 | 278 | 298 | 318 | 334 | 343 | 352 | 361 |
| 99 | 109 | 119 | 129 | 139 | 149 | 83 | 94 | 97 | 108 | 120 | 140 | 150 | 166 | 191 | 25 | 136 | 147 | 158 | 166 | 181 | 201 | 219 | 239 | 259 | 279 | 299 | 319 | 335 | 344 | 353 | 362 |
| 100 | 110 | 120 | 130 | 140 | 150 | 84 | 95 | 98 | 109 | 121 | 141 | 151 | 167 | 192 | 26 | 137 | 148 | 159 | 167 | 182 | 202 | 220 | 240 | 260 | 280 | 300 | 320 | 336 | 345 | 354 | 363 |
| 101 | 111 | 121 | 131 | 141 | 151 | 85 | 96 | 99 | 110 | 122 | 142 | 152 | 168 | 193 | 27 | 138 | 149 | 160 | 168 | 183 | 203 | 221 | 241 | 261 | 281 | 301 | 321 | 337 | 346 | 355 | 364 |
| 102 | 112 | 122 | 132 | 142 | 152 | 86 | 97 | 100 | 111 | 123 | 143 | 153 | 169 | 194 | 28 | 139 | 150 | 161 | 169 | 184 | 204 | 222 | 242 | 262 | 282 | 302 | 322 | 338 | 347 | 356 | 365 |
| 103 | 113 | 123 | 133 | 143 | 153 | 87 | 98 | 101 | 112 | 124 | 144 | 154 | 170 | 195 | 29 | 140 | 151 | 162 | 170 | 185 | 205 | 223 | 243 | 263 | 283 | 303 | 323 | 339 | 348 | 357 | 366 |
| 104 | 114 | 124 | 134 | 144 | 154 | 88 | 99 | 102 | 113 | 125 | 145 | 155 | 171 | 196 | 30 | 141 | 152 | 163 | 171 | 186 | 206 | 224 | 244 | 264 | 284 | 304 | 324 | 340 | 349 | 358 | 367 |
| 105 | 115 | 125 | 135 | 145 | 155 | 89 | 100 | 103 | 114 | 126 | 146 | 156 | 172 | 197 | 31 | 142 | 153 | 164 | 172 | 187 | 207 | 225 | 245 | 265 | 285 | 305 | 325 | 341 | 350 | 359 | 368 |
| 106 | 116 | 126 | 136 | 146 | 156 | 90 | 101 | 104 | 115 | 127 | 147 | 157 | 173 | 198 | 32 | 143 | 154 | 165 | 173 | 188 | 208 | 226 | 246 | 266 | 286 | 306 | 326 | 342 | 351 | 360 | 369 |
| 107 | 117 | 127 | 137 | 147 | 157 | 91 | 102 | 105 | 116 | 128 | 148 | 158 | 174 | 203 | 33 | 144 | 155 | 166 | 174 | 189 | 209 | 227 | 247 | 267 | 287 | 307 | 327 | 343 | 352 | 361 | 370 |
| 108 | 118 | 128 | 138 | 148 | 158 | 92 | 103 | 106 | 117 | 129 | 149 | 159 | 175 | 204 | 34 | 145 | 156 | 167 | 175 | 190 | 210 | 228 | 248 | 268 | 288 | 308 | 328 | 344 | 353 | 362 | 371 |
| 109 | 119 | 129 | 139 | 149 | 159 | 93 | 104 | 107 | 118 | 130 | 150 | 160 | 176 | 205 | 35 | 146 | 157 | 168 | 176 | 191 | 211 | 229 | 249 | 269 | 289 | 309 | 329 | 345 | 354 | 363 | 372 |
| 110 | 120 | 130 | 140 | 150 | 160 | 94 | 105 | 108 | 119 | 131 | 151 | 161 | 177 | 206 | 36 | 147 | 158 | 169 | 177 | 192 | 212 | 230 | 250 | 270 | 290 | 310 | 330 | 346 | 355 | 364 | 373 |
| 111 | 121 | 131 | 141 | 151 | 161 | 95 | 106 | 109 | 120 | 132 | 152 | 162 | 178 | 207 | 37 | 148 | 159 | 170 | 178 | 193 | 213 | 231 | 251 | 271 | 291 | 311 | 331 | 347 | 356 | 365 | 374 |
| 112 | 122 | 132 | 142 | 152 | 162 | 96 | 107 | 110 | 121 | 133 | 153 | 163 | 179 | 208 | 38 | 149 | 160 | 171 | 179 | 194 | 214 | 232 | 252 | 272 | 292 | 312 | 332 | 348 | 357 | 366 | 375 |
| 113 | 123 | 133 | 143 | 153 | 163 | 97 | 108 | 111 | 122 | 134 | 154 | 164 | 180 | 209 | 39 | 150 | 161 | 172 | 180 | 195 | 215 | 233 | 253 | 273 | 293 | 313 | 333 | 349 | 358 | 367 | 376 |
| 114 | 124 | 134 | 144 | 154 | 164 | 98 | 109 | 112 | 123 | 135 | 155 | 165 | 181 | 210 | 40 | 151 | 162 | 173 | 181 | 196 | 216 | 234 | 254 | 274 | 294 | 314 | 334 | 350 | 359 | 368 | 377 |
| 115 | 125 | 135 | 145 | 155 | 165 | 99 | 110 | 113 | 124 | 136 | 156 | 166 | 182 | 211 | 41 | 152 | 163 | 174 | 182 | 197 | 217 | 235 | 255 | 275 | 295 | 315 | 335 | 351 | 360 | 369 | 378 |
| 116 | 126 | 136 | 146 | 156 | 166 | 100 | 111 | 114 | 125 | 137 | 157 | 167 | 183 | 212 | 42 | 153 | 164 | 175 | 183 | 198 | 218 | 236 | 256 | 276 | 296 | 316 | 336 | 352 | 361 | 370 | 379 |
| 117 | 127 | 137 | 147 | 157 | 167 | 101 | 112 | 115 | 126 | 138 | 158 | 168 | 184 | 213 | 43 | 154 | 165 | 176 | 184 | 199 | 219 | 237 | 257 | 277 | 297 | 317 | 337 | 353 | 362 | 371 | 380 |
| 118 | 128 | 138 | 148 | 158 | 168 | 102 | 113 | 116 | 127 | 139 | 159 | 169 | 185 | 214 | 44 | 155 | 166 | 177 | 185 | 200 | 220 | 238 | 258 | 278 | 298 | 318 | 338 | 354 | 363 | 372 | 381 |
| 119 | 129 | 139 | 149 | 159 | 169 | 103 | 114 | 117 | 128 | 140 | 160 | 170 | 186 | 215 | 45 | 156 | 167 | 178 | 186 | 201 | 221 | 240 | 260 | 280 | 300 | 320 | 340 | 356 | 365 | 374 | 383 |
| 120 | 130 | 140 | 150 | 160 | 170 | 104 | 115 | 118 | 129 | 141 | 161 | 171 | 187 | 216 | 46 | 157 | 168 | 179 | 187 | 202 | 222 | 241 | 261 | 281 | 301 | 321 | 341 | 357 | 366 | 375 | 384 |
| 121 | 131 | 141 | 151 | 161 | 171 | 105 | 116 | 119 | 130 | 142 | 162 | 172 | 188 | 217 | 47 | 158 | 169 | 180 | 188 | 203 | 223 | 242 | 262 | 282 | 302 | 322 | 342 | 358 | 367 | 376 | 385 |
| 122 | 132 | 142 | 152 | 162 | 172 | 106 | 117 | 120 | 131 | 143 | 163 | 173 | 189 | 218 | 48 | 159 | 170 | 181 | 190 | 205 | 225 | 244 | 264 | 284 | 304 | 324 | 344 | 360 | 369 | 378 | 387 |
| 123 | 133 | 143 | 153 | 163 | 173 | 107 | 118 | 121 | 132 | 144 | 164 | 174 | 190 | 219 | 49 | 160 | 171 | 182 | 191 | 206 | 226 | 245 | 265 | 285 | 305 | 325 | 345 | 361 | 370 | 379 | 388 |
| 124 | 134 | 144 | 154 | 164 | 174 | 108 | 119 | 122 | 133 | 145 | 165 | 175 | 191 | 220 | 50 | 161 | 172 | 183 | 192 | 207 | 227 | 246 | 266 | 286 | 306 | 326 | 346 | 362 | 371 | 380 | 389 |
| 125 | 135 | 145 | 155 | 165 | 175 | 109 | 120 | 123 | 134 | 146 | 166 | 176 | 192 | 221 | 51 | 162 | 173 | 184 | 193 | 208 | 228 | 247 | | | | | | | | | |

Weights of Materials.

FILE 691.11

Dry Woods.

| | Lbs. Board ft. | Lbs. Cubic ft. | | Lbs. Board ft. | Lbs. Cubic ft. |
|--------------------------|-------------------|-------------------|--------------------------|-------------------|-------------------|
| Apple | 4.1 | 49. | Iron Wood | 6. | 71. |
| Ash, American white..... | 3.9 | 47. | Larch | 3. | 35. |
| Birch | 3.9 | 45. | Lignum vitae | 6.9 | 83. |
| Beech | 3.7 | 43. | Mahogany, Honduras | 2.9 | 35. |
| Boxwood | 5. | 60. | Mahogany, Spanish | 4.4 | 53. |
| Cedar, American | 2.9 | 35. | Maple | 4.1 | 49. |
| Cedar, W. Indian..... | 3.9 | 47. | Maple, soft | 3.5 | 42. |
| Cedar, Lebanon | 2.5 | 30. | Oak, live | 4.9 | 59.3 |
| Cherry | 3.5 | 42. | Oak, red | 3.9 | 45. |
| Chestnut | 3.4 | 41. | Oak, white | 4.3 | 52. |
| Cork | 1.3 | 15. | Pine, Southern | 3.7 | 45. |
| Elm | 2.9 | 35. | Pine, white | 2.1 | 25. |
| Ebony | 6.3 | 76.1 | Pine, yellow | 2.8 | 34.3 |
| Hemlock | 2.1 | 25. | Spruce | 2.1 | 25. |
| Hickory | 4.4 | 53. | Sycamore | 3.1 | 37. |
| Hornbeam | 2.9 | 47. | Walnut | 3.2 | 38. |

Building Materials Stacked.

| | Lbs. Cubic ft. | | Lbs. Cubic ft. |
|-----------------------------------|-------------------|---------------------------------------|-------------------|
| Brick, pressed | 150 | Granite or limestone, rubble work... | 138 |
| Brick, common | 125 | Granite or limestone, well dressed .. | 165 |
| Cement, Portland | 80 to 100 | Limestones and marbles | 168 |
| Cement, Rosedale | 56 | Lime, quick | 53 |
| Common brickwork, cement mortar.. | 130 | Mortar, hardened | 103 |
| Common brickwork, lime mortar.... | 120 | Plaster of paris | 141.6 |
| Concrete cement | 140 | Sand | 90-106 |
| Earth dry, shaken | 82 to 92 | Sandstone | 151 |
| Earth, rammed | 92 to 100 | Shales | 162 |
| Glass, window | 157 | Slate | 175 |
| Granite | 170 | Trap rock | 187 |

BUILDING MATERIALS IN CONSTRUCTION.

| Roof Covering. | Lbs. per sq. ft. |
|--------------------------------------|------------------|
| Shingles, wood, 16"..... | 2. |
| Tin and paint | 1. |
| Iron sheet black and paint..... | 1.5 |
| Iron, galvanized | 1 to 3. |
| Iron, corrugated | 1 to 3.75 |
| Copper, sheet | .75 to 1.25 |
| Sheet Lead (See File 695) | 4 to 8. |
| Zinc | 1 to 2.00 |
| Ready Compo Roofing..... | 1 to 1.50 |
| Felt and gravel..... | 8 to 10.00 |
| States, average (See File 695) | 19.00 |
| Tiles, plain, average..... | 12.00 |
| Tiles, fancy, laid in mortar..... | 25 to 30. |

Sheathing, Flooring, Etc.

| | |
|--|-----|
| Pine, Hemlock, Spruce, Poplar, Redwood, per inch thick..... | 3. |
| Chestnut or Maple..... | 4. |
| Ash, Hickory, L. L. Y. P., Oak.. | 5. |
| Brick arches, 4" thick & concrete | 70. |
| Porous tiles for slating, without slate | 10. |
| Hollow tiles, 3.75" flat..... | 12. |
| Hollow tiles, 6" arches..... | 22. |
| Hollow tiles, 9" arches..... | 36. |

Joists and Rafters.

| | Lbs. per sq. ft. |
|------------------------------------|------------------|
| White pine, 2"x4", 16" o, c | 1.5 |
| Y. P. 2"x4", 16" o, c | 2.5 |
| White pine, 2"x6", 16" o, c | 2.25 |
| Y. P. 2"x6", 16" o, c | 3.75 |
| White pine, 2"x8", 16" o, c | 3.00 |
| Y. P. 2"x8", 16" o, c | 5.0 |
| White pine, 2"x10", 16" o, c | 3.75 |
| Y. P. 2"x10", 16" o, c | 6.25 |

Purlines.

| | |
|--|--------|
| Wood, if supporting rafters..... | 1 to 3 |
| Iron or Steel, if supporting rafters.. | 2 to 4 |

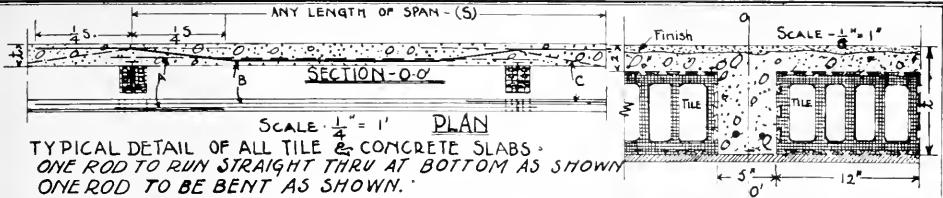
Ceiling.

| | |
|---|----|
| Wainscoting or D. M. & B. stuff, same as sheathing. | |
| Lath and plaster, 2 coats..... | 9 |
| Lath and plastering, 3 coats..... | 10 |
| Light book tiles, supported by T-bars without plastering | 5 |

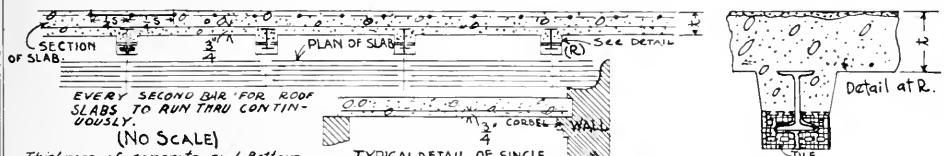
Live Loads.

See building code. Snow load for New York City, Cleveland, Chicago, Des Moines, averages about 20 lbs.

NOTE.—Mr. Winslow was prevented from presenting his work on the application of the new building ordinances on account of their not being adopted at time of going to press. We hope that these can be presented next year.—Editor.



TYPICAL DETAIL OF CONTINUOUS REINFORCED CONCRETE SLAB.



(NO SCALE)

Thickness of concrete and bottom reinforcement as given in table.

Top reinforcement (rods) to be of same section as those of bottom. - SPACE TOP PARS TWICE BOTTOM BAR SPACING. TOP BARS TO PROJECT ONE-FOURTH THE SPAN BEYOND THE SUPPORT. CROSS RODS AT RIGHT ANGLES TO MAIN CARRYING RODS WILL BE $\frac{3}{8}$ " PLACED 18" ON CENTERS. Ends of bars should be bent to form a small hook and entirely covered with at least $\frac{3}{8}$ " concrete

REINFORCED COMBINATION CONCRETE - TILE FLOOR SLABS - 100-LBS. LIVE LOAD.

REINFORCED CONCRETE SLABS FOR FLOORS - 100LBS. LIVE LOAD

| SPAN | CONTINUOUS BEAMS | SIMPLY SUPPORTED BEAM | CONTINUOUS SLABS | SIMPLY SUPPORTED SLABS | | | | | | | |
|--|------------------|-----------------------|-------------------------------|------------------------|---------------|-------------------------------|------------------|---|---|----------------|--|
| S | TILE | CONCRETE | RODS | TILE | CONCRETE | RODS | | | | | |
| 16'-0" | 7" | 2" | $2 - \frac{5}{8}'' - \square$ | 7" | 2 | $2 - \frac{5}{8}'' - \square$ | | | | | |
| 15'-0" | 7" | 2" | $2 - \frac{5}{8}'' - \square$ | 7" | 2 | $2 - \frac{5}{8}'' - \square$ | | | | | |
| 14'-0" | 6" | 2" | $2 - \frac{1}{2}'' - \square$ | 7" | 2 | $2 - \frac{5}{8}'' - \square$ | | | | | |
| 13'-0" | 5" | 2" | $2 - \frac{1}{2}'' - \square$ | 7" | 2 | $2 - \frac{5}{8}'' - \square$ | | | | | |
| 12'-0" | 4" | 2" | $2 - \frac{1}{2}'' - \square$ | 6" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 11'-0" | 4" | 2" | $2 - \frac{1}{2}'' - \square$ | 5" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 10'-0" | 4" | 2" | $2 - \frac{1}{2}'' - \square$ | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 9'-0" | 4" | 2" | $2 - \frac{1}{2}'' - \square$ | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 8'-0" | 4" | 2" | $2 - \frac{1}{2}'' - \square$ | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 7'-0" | 3" | 2" | $2 - \frac{3}{8}'' - \square$ | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | | | | | |
| 6'-0" | 3" | 2" | $2 - \frac{3}{8}'' - \square$ | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | | | | | |
| 5'-0" | 3" | 2" | $2 - \frac{3}{8}'' - \square$ | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | | | | | |
| 4'-0" AND LESS | 3" | 2" | $2 - \frac{3}{8}'' - \square$ | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | | | | | |
| REINFORCED COMBINATION CONCRETE TILE ROOF SLABS - 25 LBS. LIVE LOAD. | | | | | | | | | | | |
| 16'-0" | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | 5" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 15'-0" | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | 5" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 14'-0" | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | 5" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 13'-0" | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 12'-0" | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 11'-0" | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 10'-0" | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | 4" | 2 | $2 - \frac{1}{2}'' - \square$ | | | | | |
| 9'-0" | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | | | | | |
| 8'-0" | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | | | | | |
| 7'-0" | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | | | | | |
| 6'-0" AND LESS | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | 3" | 2 | $2 - \frac{3}{8}'' - \square$ | | | | | |
| REINFORCED CONCRETE SLABS - FOR ROOF - 25LBS. LIVE LOAD | | | | | | | | | | | |
| 14'-0" | 4 $\frac{1}{2}$ | $\frac{3}{8}$ | $4\frac{1}{2}''$ | $5\frac{1}{2}''$ | $\frac{1}{2}$ | $6\frac{1}{2}''$ | $6'' 10''$ | 2 | 1 | $\frac{7}{16}$ | |
| 13'-0" | 4 $\frac{1}{2}$ | $\frac{3}{8}$ | $5\frac{1}{2}''$ | $5''$ | $\frac{3}{8}$ | $4''$ | $6'' 10''$ | 2 | 1 | $\frac{7}{16}$ | |
| 12'-0" | 4 $\frac{1}{2}$ | $\frac{3}{8}$ | $5\frac{1}{2}''$ | $4\frac{1}{2}''$ | $\frac{1}{2}$ | $4\frac{1}{2}''$ | $6'' 9''$ | 2 | 1 | $\frac{3}{8}$ | |
| 11'-0" | 3 $\frac{1}{2}$ | $\frac{3}{8}$ | $6''$ | $4\frac{1}{2}''$ | $\frac{3}{8}$ | $4\frac{1}{2}''$ | $5'' 9''$ | 2 | 1 | $\frac{3}{8}$ | |
| 10'-0" | 3 $\frac{1}{2}$ | $\frac{3}{8}$ | $6\frac{1}{2}''$ | $4''$ | $\frac{3}{8}$ | $5\frac{1}{2}''$ | $5'' 9''$ | 2 | 1 | $\frac{3}{8}$ | |
| 9'-0" | 3 $\frac{1}{2}$ | $\frac{3}{8}$ | $5\frac{1}{2}''$ | $5''$ | $\frac{3}{8}$ | $4''$ | $6'' 10''$ | 2 | 1 | $\frac{3}{8}$ | |
| 8'-0" | 3 $\frac{1}{2}$ | $\frac{3}{8}$ | $6\frac{1}{2}''$ | $4\frac{1}{2}''$ | $\frac{3}{8}$ | $4\frac{1}{2}''$ | $5'' 9''$ | 2 | 1 | $\frac{3}{8}$ | |
| 7'-0" | 2 $\frac{1}{2}$ | $\frac{1}{4}$ | $4\frac{1}{2}''$ | $3\frac{1}{2}''$ | $\frac{1}{2}$ | $3\frac{1}{2}''$ | $4'' 8''$ | 2 | 1 | $\frac{5}{16}$ | |
| 6'-0" | 2 $\frac{1}{2}$ | $\frac{1}{4}$ | $4\frac{1}{2}''$ | $3\frac{1}{2}''$ | $\frac{1}{2}$ | $3\frac{1}{2}''$ | $4'' 8''$ | 2 | 1 | $\frac{5}{16}$ | |
| 3'-0" AND LESS | 2 $\frac{1}{2}$ | $\frac{1}{4}$ | $5''$ | $2\frac{1}{4}''$ | $4''$ | $3\frac{1}{2}''$ | $8''$ | 2 | 0 | $\frac{1}{4}$ | |
| REINFORCED CONCRETE SLABS - FOR ROOF - 25LBS. LIVE LOAD | | | | | | | | | | | |
| 14'-0" | 4 $\frac{1}{2}$ | $\frac{3}{8}$ | $4\frac{1}{2}''$ | $5\frac{1}{2}''$ | $\frac{1}{2}$ | $6\frac{1}{2}''$ | $6'' 10''$ | 2 | 1 | $\frac{7}{16}$ | |
| 13'-0" | 4 $\frac{1}{2}$ | $\frac{3}{8}$ | $5\frac{1}{2}''$ | $5''$ | $\frac{3}{8}$ | $4''$ | $6'' 10''$ | 2 | 1 | $\frac{7}{16}$ | |
| 12'-0" | 4 $\frac{1}{2}$ | $\frac{3}{8}$ | $5\frac{1}{2}''$ | $4\frac{1}{2}''$ | $\frac{1}{2}$ | $4\frac{1}{2}''$ | $6'' 9''$ | 2 | 1 | $\frac{3}{8}$ | |
| 11'-0" | 3 $\frac{1}{2}$ | $\frac{3}{8}$ | $6''$ | $4\frac{1}{2}''$ | $\frac{3}{8}$ | $4\frac{1}{2}''$ | $5'' 9''$ | 2 | 1 | $\frac{3}{8}$ | |
| 10'-0" | 3 $\frac{1}{2}$ | $\frac{3}{8}$ | $6\frac{1}{2}''$ | $4''$ | $\frac{3}{8}$ | $5\frac{1}{2}''$ | $4'' 8''$ | 2 | 1 | $\frac{3}{8}$ | |
| 9'-0" | 3 $\frac{1}{2}$ | $\frac{3}{8}$ | $5\frac{1}{2}''$ | $3\frac{1}{2}''$ | $\frac{3}{8}$ | $6\frac{1}{2}''$ | $4'' 8''$ | 2 | 1 | $\frac{3}{8}$ | |
| 8'-0" | 3 $\frac{1}{2}$ | $\frac{3}{8}$ | $6\frac{1}{2}''$ | $3\frac{1}{2}''$ | $\frac{3}{8}$ | $3\frac{1}{2}''$ | $4'' 8''$ | 2 | 1 | $\frac{5}{16}$ | |
| 7'-0" | 2 $\frac{1}{2}$ | $\frac{1}{4}$ | $4\frac{1}{2}''$ | $3\frac{1}{2}''$ | $\frac{1}{2}$ | $3\frac{1}{2}''$ | $4'' 8''$ | 2 | 1 | $\frac{5}{16}$ | |
| 6'-0" | 2 $\frac{1}{2}$ | $\frac{1}{4}$ | $6''$ | $2\frac{1}{2}''$ | $\frac{1}{2}$ | $4\frac{1}{2}''$ | $4'' 8''$ | 2 | 1 | $\frac{5}{16}$ | |
| 3'-0" AND LESS | 2 $\frac{1}{2}$ | $\frac{1}{4}$ | $3\frac{1}{2}''$ | $2\frac{1}{2}''$ | $\frac{1}{2}$ | $4''$ | $3\frac{1}{2}''$ | 0 | 0 | $\frac{1}{4}$ | |

BY BENJAMIN E. WINSLOW, M.W.S.E.

VELOCITY OF WIND.

| | | | |
|----------------------------|------|------|---|
| 10 miles, per square foot, | 0.49 | lbs. | 50 miles, per square foot, 12.304 lbs. |
| 20 miles, per square foot, | 1.97 | lbs. | 60 miles, per square foot, 17.733 lbs. |
| 30 miles, per square foot, | 4.43 | lbs. | 70 miles, per square foot, 24.153 lbs. |
| 40 miles, per square foot, | 7.87 | lbs. | 100 miles, per square foot, 49.200 lbs. |

LIQUID MEASURE.

| | |
|--------------------|----------------------------|
| 3½ gallons | = 1 barrel. |
| 2 barrels | = 1 hogshead. |
| 1 barrel | = 4½ cubic feet. |
| 8.665 cubic inches | = 1 gill. |
| 4 gills | = 1 pint = 33.6 c. inches. |

| | |
|----------------|-------------------------------|
| 2 pints | = 1 quart = 67.2 c. inches. |
| 4 quarts | = 1 gallon = 268.8 c. inches. |
| 1 gallon U. S. | = 8.34 lb. |
| 1 gallon U. S. | = 231 cubic inches. |
| 1 cubic foot | = 7.48 U. S. gallons. |

DRY MEASURE.

| | |
|-------------------|---------------------|
| 1 barrel pork | = 200 pounds. |
| 1 barrel fish | = 200 pounds. |
| 1 barrel flour | = 196 pounds. |
| 1 barrel salt | = 280 pounds. |
| 1 barrel beef | = 200 pounds. |
| 1 bushel corn | = 56 pounds. |
| 1 bushel oats | = 30 to 33½ pounds. |
| 1 bushel wheat | = 60 pounds. |
| 1 bushel potatoes | = 60 pounds. |
| 2 gallons | = 1 peck. |

| | |
|-----------------------|--------------------|
| 8 gallons | = 1 bushel. |
| 6½ gallons | = 1 quarter. |
| 1 bushel | = 1.28 cubic feet. |
| 1 cubic foot corn | = 42 pounds. |
| 1 cubic foot rice | = 48 pounds. |
| 1 cubic foot hops | = 27 pounds. |
| 1 earload | = 680 bushels. |
| 1 c. foot Anthr. coal | = 54 lbs. |
| 1 ton Anthr. coal | = abt. 40 c. ft. |

PAPER.

| | |
|-----------|---------------------|
| 24 sheets | = 1 quire. |
| 20 sheets | = 1 quire outsides. |
| 25 sheets | = 1 quire printers. |
| 20 quires | = 1 ream. |

| | |
|------------|------------------------|
| 21½ quires | = 1 ream printers'. |
| 2 reams | = 1 bundle. |
| 10 reams | = 1 bale. |
| 60 skins | = 1 roll of parchment. |

WEIGHTS AND MEASURES—LINEAL MEASURE.

| | |
|----------------------|--------------------------|
| 2½ inches | = 1 nail. |
| 4 inches | = 1 hand. |
| 3 inches | = 1 palm. |
| 9 inches | = 1 span. |
| 12 inches | = 1 foot. |
| 45 inches | = 1 ell. |
| 3 feet | = 1 yard. |
| 6 feet | = 1 fathom. |
| 16½ feet or 5½ yards | = 1 rod, pole, or perch. |

| | |
|--------------------------|-----------------------|
| 4 poles or 22 yards | = 1 chain. |
| 220 yards or 40 poles | = 1 furlong. |
| 1760 yards or 8 furlongs | = 1 mile. |
| 7.92 inches | = 1 link. |
| 100 links or 66 ft. | = 1 chain. |
| 10 chains | = 1 furlong. |
| 80 chains | = 1 mile. |
| 3 miles | = 1 league. |
| 240 yards | = 1 cable length. |
| 6086.07 feet | = 1 knot or sea mile. |

LENGTH OF A FOOT IN DIFFERENT COUNTRIES.

| | Inches. | | Inches. |
|---------|---------|----------|---------|
| Spain | 11.03 | Denmark | 12.35 |
| Holland | 11.14 | Prussia | 12.36 |
| Sweden | 11.14 | Austria | 12.45 |
| America | 12 | Portugal | 12.96 |
| England | 12 | Russia | 13.75 |

LENGTH OF A MILE IN DIFFERENT COUNTRIES.

| | Am. yards. | | Am. yards. |
|----------|------------|--------------------|------------|
| Russian | 1,100 | Spanish | 5,028 |
| Italian | 1,467 | German | 5,866 |
| English | 1,760 | Swedish and Danish | 7,233 |
| American | 1,760 | Hungarian | 8,630 |
| Scotch | 1,984 | Norwegian | 12,400 |
| Irish | 2,200 | French league | 3,666 |
| Polish | 4,400 | | |

SQUARE MEASURE.

| | | | |
|-----------------------|-------------------------|--------------------------|-------------------|
| 144 square inches | = 1 square foot. | 2,471 acres | = 1 hectare. |
| 9 square feet | = 1 square yard. | 7,840 square yards | = 1 Irish acre. |
| 27 $\frac{1}{4}$ feet | = 1 square rod or pole. | 6150 square yards | = 1 Scotch acre. |
| 40 rods | = 1 square rood. | 30 square acres | = 1 yard of land. |
| 4 rods | | 100 acres | = 1 hide of land. |
| 160 rods | | 40 hides | = 1 barony. |
| 4,840 yards. | | 36 sq. miles | = 1 township. |
| 43,560 feet | | 640 acres | = 1 section. |
| 10 square chains | | About 14 25x125 ft. lots | = 1 acre. |
| 640 acres | = 1 square mile. | | |

SOLID OR CUBIC MEASURE.

| | | | |
|---|------------------|----------------|----------------------------|
| 1728 cubic inches | = 1 cubic foot. | 108 cubic feet | = 1 stack of wood. |
| 27 cubic feet | = 1 cubic yard. | 128 cubic feet | = 1 cord of wood. |
| 40 cubic feet of rough or 50 cubic feet of hewn timber | = 1 ton or load. | 40 c. ft. | = 1 U. S. A. shipping ton. |
| | | 42 c. ft. | = 1 British shipping ton. |

AVOIRDUPOIS WEIGHT.

| | | | |
|------------|--------------|------------|----------|
| 16 drachms | = 1 ounce. | 112 pounds | = 1 cwt. |
| 16 ounces | = 1 pound. | 20 cwt. | = 1 ton. |
| 28 pounds | = 1 quarter. | | |

TROY WEIGHT.

| | | | |
|-----------|----------|--------|---------|
| 24 grains | = 1 dwt. | 12 oz. | = 1 lb. |
| 20 dwt. | = 1 oz. | | |

SIZES OF PAPER (Whatman's).

| | Inches. | | Inches. |
|-----------------|-------------------------------------|------------|-------------------------------------|
| Emperor | 72 x 48 | Royal | 24 x 19 |
| Antiquarian | 53 x 31 | Medium | 22 x 17 $\frac{1}{2}$ |
| Double elephant | 40 x 26 $\frac{3}{4}$ | Demy | 20 x 15 $\frac{1}{2}$ |
| Atlas | 34 x 26 | Large post | 20 $\frac{3}{4}$ x 16 $\frac{3}{4}$ |
| Colombier | 34 $\frac{1}{2}$ x 23 $\frac{1}{2}$ | Post | 19 x 15 $\frac{1}{4}$ |
| Imperial | 30 x 22 | Foolscap | 17 x 13 $\frac{1}{2}$ |
| Elephant | 28 x 23 | Post | 15 x 12 $\frac{1}{2}$ |
| Super royal | 27 x 19 | Copy | 20 x 16 |

Water.

| |
|--|
| 1 cubic foot of water equals 62.5 pounds, or 7.48 U. S. gallons. |
| 1 cubic inch of water equals .036 pounds. |
| 1 cubic foot of water equals 6.2355 Imp. gallons or 7.48 U. S. gallons. |
| 1 cylindrical foot of water equals 49.1 pounds or 5.89 U. S. gallons. |
| 1 U. S. gallon of water equals 8.34 pounds. |
| 1 U. S. gallon of water equals 231 cubic inches. |
| 1 pound pressure per square inch is equivalent to a head of water of 2.3093 feet; |
| 1 pound—27.71 inches; 14.7 pounds or 1 atmosphere—33.947 feet, or 10.347 metres; 0.433 pound or 1 atmosphere—1 foot; 43.3 pounds—100 feet. |

Gauges and Their Equivalents.

| | | |
|--------------------------------------|--|--------------------------------------|
| No. 27, equal to $\frac{1}{4}$ inch. | | No. 12, equal to $\frac{5}{4}$ inch. |
| " 21, " " $\frac{3}{2}$ " " | | " 10, " " $\frac{1}{8}$ " " |
| " 18, " " $\frac{3}{4}$ " " | | " 8, " " $\frac{1}{16}$ " " |
| " 16, " " $\frac{1}{2}$ " " | | " 6, " " $\frac{3}{16}$ " " |
| " 14, " " $\frac{5}{8}$ " " | | " 5, " " $\frac{1}{16}$ " " |
| " 13, " " $\frac{3}{2}$ " " | | " 4, " " $\frac{1}{4}$ " " |

Metric Tables.

| | Approximate. Equivalent | Accurate. Equivalent | |
|--|----------------------------|----------------------------|--------|
| 1 inch | [length].. $2\frac{1}{2}$ | cubic centimeters | 2.539 |
| 1 centimeter | 0.4 | inch | 0.393 |
| 1 yard | 1 | meter | 0.914 |
| 1 meter (39.37 inches) | 1 | yard | 1.093 |
| 1 foot | 30 | centimeters | 30.479 |
| 1 kilometer (1,000 meters) | $\frac{5}{8}$ | mile | 0.621 |
| 1 mile | $1\frac{1}{2}$ | kilometers | 1.600 |
| 1 gramme | [weight].. $15\frac{1}{2}$ | grains | 15.432 |
| 1 grain | 0.064 | gramme | 0.064 |
| 1 kilogramme (1,000 grammes) | 2.2 | pounds avoirdupois | 2.204 |
| 1 pound avoirdupois | $\frac{1}{2}$ | kilogramme | 0.453 |
| 1 ounce avoirdupois (437 $\frac{1}{2}$ grains) | $28\frac{1}{3}$ | grammes | 28.349 |
| 1 ounce troy, or apothecary (480 grains) .. | 31 | grammes | 31.103 |
| 1 cubic centimeter | [bulk].. 1.06 | cubic inch | 1.060 |
| 1 cubic inch | $16\frac{1}{3}$ | cubic centimeters | 16.386 |
| 1 liter (1,000 cubic centimeters) | 1 | U. S. standard quart | 0.946 |
| 1 United States quart | 1 | liter | 1.057 |
| 1 fluid ounce | $29\frac{1}{2}$ | cubic centimeters | 29.570 |
| 1 hectare (10,000 square meters) [surface] .. | $2\frac{1}{2}$ | acres | 2.471 |
| 1 acre | 0.4 | hectare | 0.40 |

In the nickel five-cent piece of our coinage is a key to the tables of linear measures and weights. The diameter of this coin is two centimeters, and its weight is five grammes. Five of them placed in a row will give the length of the decimeter, and two of them will weigh a decagram. As the kiloliter is a cubic meter, the key to the measure of length is also the key to the measure of capacity.

Handy Table.

| |
|--|
| Diameter of a circle $\times 3.1416$ = circumference. |
| Radius of a circle $\times 6.283185$ = circumference. |
| Square of the diameter of a circle $\times 0.7854$ = area. |
| Square of the circumference of a circle $\times 0.07958$ = area. |
| Half the circumference of a circle \times half its diameter = area. |
| Circumference of a circle $\times 0.159155$ = radius. |
| Square root of the area of a circle + 0.56419 = radius. |
| Circumference of a circle $\times 0.31831$ = diameter. |
| Square root of the area of a circle $\times 1.12838$ = diameter. |
| Diameter of a circle $\times 0.86$ = side of inscribed equilateral triangle. |
| Diameter of a circle $\times 0.7071$ = side of an inscribed square. |
| Circumference of a circle + 0.225 = side of an inscribed square. |
| Circumference of a circle $\times 0.282$ = side of an equal square. |
| Diameter of a circle $\times 0.8862$ = side of an equal square. |
| Base of a triangle $\times \frac{1}{2}$ the altitude = area. |
| Multiplying both diameters and .7854 together = area of an ellipse. |
| Surface of a sphere $\times \frac{1}{6}$ of its diameter = solidity. |
| Circumference of a sphere \times its diameter = surface. |
| Square of the diameter of a sphere $\times 3.1416$ = surface. |
| Square of the circumference of a sphere $\times 0.3183$ = surface. |
| Cube of the diameter of a sphere $\times 0.5236$ = solidity. |
| Cube of the radius of a sphere $\times 4.1888$ = solidity. |
| Cube of the circumference of a sphere $\times 0.016887$ = solidity. |
| Square root of the surface of a sphere $\times 0.56419$ = diameter. |
| Square root of the surface of a sphere + 1.772454 = circumference. |
| Cube root of the solidity of a sphere $\times 1.2407$ = diameter. |
| Cube root of the solidity of a sphere $\times 3.8978$ = circumference. |
| Radius of a sphere $\times 1.1547$ = side of inscribed cube. |

Square root of ($\frac{1}{6}$ of the square of) the diameter of a sphere = side of inscribed cube.
 Area of its base $\times \frac{1}{3}$ of its altitude = solidity of a cone or pyramid, whether round, square, or triangular.

Area of one of its sides $\times 6$ = surface of a cube.

Altitude of trapezoid $\times \frac{1}{2}$ the sum of its parallel sides = area.

TABLE OF SQUARE ROOTS.

| No. | Sq. Root. | No. | Sq. Root. | No. | Sq. Root. | No. | Sq. Root. |
|-----|-----------|------|-----------|------|-----------|------|-----------|
| 25 | 5. | 650 | 25.46 | 1400 | 37.42 | 2600 | 50.99 |
| 50 | 7.071 | 700 | 26.46 | 1450 | 38.08 | 2700 | 51.96 |
| 75 | 8.66 | 750 | 27.39 | 1500 | 38.73 | 2800 | 52.91 |
| 100 | 10.00 | 800 | 28.28 | 1550 | 39.37 | 2900 | 53.85 |
| 125 | 11.18 | 850 | 29.15 | 1600 | 40.00 | 3000 | 54.77 |
| 150 | 12.25 | 900 | 30.00 | 1650 | 40.62 | 3200 | 56.57 |
| 175 | 13.23 | 950 | 30.82 | 1700 | 41.23 | 3400 | 58.30 |
| 200 | 14.14 | 1000 | 31.62 | 1800 | 42.43 | 3600 | 60.00 |
| 250 | 15.81 | 1050 | 32.40 | 1900 | 43.59 | 3800 | 61.64 |
| 300 | 17.32 | 1100 | 33.16 | 2000 | 44.72 | 4000 | 63.24 |
| 350 | 18.70 | 1150 | 33.91 | 2100 | 45.82 | 4200 | 64.80 |
| 400 | 20.00 | 1200 | 34.64 | 2200 | 46.90 | 4400 | 66.32 |
| 450 | 21.21 | 1250 | 35.36 | 2300 | 47.95 | 4600 | 67.82 |
| 500 | 22.36 | 1300 | 36.06 | 2400 | 48.99 | 4800 | 69.28 |
| 550 | 23.45 | 1350 | 36.74 | 2500 | 50.00 | 5000 | 70.72 |
| 600 | 24.49 | | | | | | |

Dimensions of a Barrel.—Diameter of head, 17 inches; bung, 19 inches; length, 28 inches; volume, 7,680 cubic inches.

Expansion of Water (Dalton).

| Temperature. | Expansion. | Temperature. | Expansion. | Temperature. | Expansion. |
|--------------|------------|--------------|------------|--------------|------------|
| 22° | 1.0009 | 72° | 1.0018 | 152° | 1.01934 |
| 32 | 1 | 92 | 1.00477 | 172 | 1.02575 |
| *46 | 1 | 112 | 1.0088 | 192 | 1.03265 |
| 52 | 1.00021 | 132° | 1.01367 | 212 | 1.0466 |

*Greatest density at 39.1° Fahr.

A box 24 inches long by 16 inches wide and 28 inches deep will contain a barrel, or three bushels; 24 by 16 inches and 14 inches deep contains half a barrel; 16 inches square and 8 $\frac{2}{5}$ inches deep will contain one bushel; 16 by 8 $\frac{2}{5}$ inches and 8 inches deep will contain half a bushel; 8 by 8 $\frac{2}{5}$ inches and 8 inches deep will contain one peck; 8 inches square and 4 $\frac{1}{2}$ inches deep will contain one gallon; 7 by 4 inches and 4 $\frac{1}{2}$ inches deep will contain half a gallon; 4 inches square and 4 $\frac{1}{2}$ inches deep will contain one quart; 4 feet long, 3 feet 5 inches wide and 2 feet 8 inches deep will contain one ton of coal, or 36 cubic feet.

Table Showing the Pressure of Water at Different Elevations.

| Feet Head | Equals Pressure per Square Inch. | Feet Head | Equals Pressure per Square Inch |
|--------------|--|--------------|---|--------------|---|--------------|---|--------------|---|--------------|---|
| 1 | 43 | 65 | 28.15 | 130 | 56.31 | 195 | 84.47 | 260 | 112.62 | 350 | 151.61 |
| 5 | 210 | 70 | 30.32 | 135 | 55.48 | 200 | 86.63 | 265 | 114.79 | 360 | 155.94 |
| 10 | 433 | 75 | 32.45 | 140 | 60.64 | 205 | 88.80 | 270 | 116.96 | 370 | 160.27 |
| 15 | 649 | 80 | 34.65 | 145 | 62.81 | 210 | 90.96 | 275 | 119.12 | 380 | 164.61 |
| 20 | 866 | 85 | 35.82 | 150 | 64.97 | 215 | 93.14 | 280 | 121.29 | 390 | 168.94 |
| 25 | 10.82 | 90 | 38.95 | 155 | 67.14 | 220 | 95.30 | 285 | 123.45 | 400 | 173.27 |
| 30 | 12.99 | 95 | 41.15 | 160 | 69.31 | 225 | 97.49 | 290 | 125.62 | 500 | 216.58 |
| 35 | 15.16 | 100 | 43.31 | 165 | 71.47 | 230 | 99.63 | 295 | 127.75 | 600 | 259.90 |
| 40 | 17.32 | 105 | 45.45 | 170 | 73.64 | 235 | 101.79 | 300 | 129.95 | 700 | 303.22 |
| 45 | 19.49 | 110 | 47.64 | 175 | 75.80 | 240 | 103.96 | 310 | 134.28 | 800 | 346.54 |
| 50 | 21.65 | 115 | 49.81 | 180 | 77.97 | 245 | 106.13 | 320 | 135.62 | 900 | 389.86 |
| 55 | 23.82 | 120 | 51.95 | 185 | 80.14 | 250 | 108.29 | 330 | 142.95 | 1,000 | 433.18 |
| 60 | 25.99 | 125 | 54.15 | 190 | 82.30 | 255 | 110.46 | 340 | 147.28 | | |

MATERIALS.

Results of tests by Prof. Thomas Wilson to ascertain the amount of light passing through or obstructed by glass.

FILE 691.6

| | Percentage of Light. | |
|--|----------------------|-------------|
| | Admitted. | Obstructed. |
| | | |
| American Crystal, ground one side | 50.00 | 50.00 |
| Clear Plate..... | 87.50 | 12.50 |
| American Crystal, clear, double thick..... | 87.50 | 12.50 |
| American Crystal, clear, single thick..... | 87.50 | 12.50 |
| Plate, ground one side..... | 50.00 | 50.00 |
| Plate, ground two sides..... | 37.50 | 62.50 |
| American Crystal, ground two sides..... | 37.50 | 62.50 |
| Hammered $\frac{1}{4}$ inch thick | 87.50 | 12.50 |
| Ribbed $\frac{1}{4}$ inch thick..... | 75.00 | 25.00 |

FILE 691.6

Solders.

| | Copper. | Tin. | Lead. | Zinc. | Silver. | Bismuth | Gold. | Cadmium. | Antimony. |
|-----------------------------------|---------|------|-------|-------|---------|---------|-------|----------|-----------|
| Tin | | 25 | 75 | | | | | | |
| Tin | | 58 | 16 | | | | | | |
| Tin, coarse, melts at 500°..... | | 33 | 67 | | | | | | |
| Tin, ordinary, melts at 360°..... | | 67 | 33 | | | | | | |
| Spelter, soft..... | 50 | | | 50 | | | | | |
| Spelter, hard..... | 65 | | | 35 | | | | | |
| Lead | | 33 | 67 | | | | | | |
| Steel | 13 | | | 5 | 82 | | | | |
| Brass or Copper | 50 | | | 50 | | | | | |
| Fine Brass | 47 | | | 47 | 6 | | | | |
| Pewterer's, or soft..... | | 33 | 45 | | | | 22 | | |
| Pewterer's, or soft..... | | 50 | 25 | | | | 25 | | |
| Plumber's pot metal..... | | 33 | 67 | | | | | | |
| " " coarse | | 25 | 75 | | | | | | |
| " " fine | | 67 | 33 | | | | | | |
| " " fusible | | 50 | 50 | | | | | | |
| " " very fusible..... | | 25 | 25 | | | | 50 | | |
| Gold | | 4 | | | | | 7 | 89 | |
| Gold, hard..... | | 66 | | | 34 | | | | |
| Gold, soft..... | | 66 | 34 | | | | | | |
| Silver, hard..... | | 20 | | | | | 80 | | |
| Silver, soft | | 12 | | | | | 67 | | 21 |
| Pewter | | | 40 | 20 | | | 40 | | |
| Iron | | 66 | | | 33 | | | | |
| Copper | | 53 | 47 | | | | | | |

Weight per Square Foot of Sheet Lead.

| | | | |
|-------------------------------|--------------------|-------------------------------|--------|
| $\frac{1}{2}$ inch thick..... | 2 lbs. | $\frac{1}{0}$ inch thick..... | 7 lbs. |
| $\frac{3}{4}$ " " | 21 $\frac{1}{2}$ " | $\frac{1}{5}$ " " | 8 " |
| $\frac{1}{2}$ " " | 3 " | $\frac{3}{2}$ " " | 10 " |
| $\frac{2}{5}$ " " | 4 " | $\frac{1}{6}$ " " | 12 " |
| $\frac{1}{6}$ " " | 5 " | $\frac{1}{2}$ " " | 14 " |
| $\frac{1}{4}$ " " | 6 " | $\frac{1}{4}$ " " | 16 " |
| $\frac{1}{2}$ " " | | | |

Limes and Cements.—Natural limes and cements are produced by calcining limestones and other calcareous materials, in which process the carbonic acid and moisture they contain are driven off.

Hydraulic Limes are calcined from stone containing 73 to 92 per cent. of carbonate of lime, and a portion of clay, also soluble silica, carbonate of magnesia, alkalies, metallic oxides, and sulphates.

Cements.—There is no precise line between hydraulic limes and cements, the latter containing a larger proportion of clay than limes.

Natural Cements are calcined from stones containing carbonate of lime, a mixture of carbonate of lime and magnesia, together with a proportion of from 30 to 50 per cent. of clay. More than 40 per cent. of clay is injurious to the cements.

Hydraulic Cements are artificial cements made in a similar manner to hydraulic lime, but with a larger proportion of clay, silica, alumina, magnesia, etc. They do not slack after calcination, and some set under water at a temperature of 65 degrees in from 3 to 5 minutes and others in as many hours.

Portland Cement is an artificial cement. Good cement should be ground very fine, and should weigh from 95 to 130 pounds to the struck bushel. Slow setting cement is strongest. It is very important that sand used with cement be perfectly clean and sharp.

Mortar is lime and sand mixed with water. The setting process is a chemical change, the lime and the carbonic acid in the air combining to form a carbonate of lime, which as a cementing element encloses and binds together the particles of sand. The sand should be perfectly free from clay, loam or other impurities, or substitutes for sand may be used in the shape of well burnt clay, coriae from iron-works, slag from furnaces and cinders from coals.

Gypsum, or hydrated sulphate of lime is the basis of most plasters. It is a soft stone, which is either simply calcined, or calcined and combined with salts and alkalies.

Plaster of Paris is gypsum gently calcined till nearly the whole of the moisture is driven off. It can be cast in almost any form in wax or guttapercha moulds. It is also used with other plasters to quicken the setting.

Keene's Cement is plaster of paris soaked in a solution of alum and recalcined.

Parian Cement is gypsum calcined and powdered and mixed with a solution of borax, recalcined, ground, and mixed with a solution of alum.

Coarse Stuff is lime water mixed with hair or fiber.

Fine Stuff is lime slaked to a paste run to the consistency of cream, and allowed to harden to the required consistency for working by evaporation.

Gauged Stuff is plaster of paris added in the proportion of about 1 to 4 for its more rapid setting.

Rough Cast is washed gravels mixed with hot hydraulic lime; it is thrown with large trowels in a semi-fluid state upon an even surface of coarse stuff, and colored with lime wash and ochre.

Depeter is a "pricked up" coat of coarse stuff, into which small stone are pressed while in a wet state.

Depreter is plaster finished with a surface similar to cooled stone.

Pugging is coarse stuff put between floors for the purpose of deafening.

Papier Mache is paper reduced to a pulp or sheets of paper glued together and pressed in a metal mould to a required form.

Carton Pierre is similar to papier mache, but made with paper pulp, whiting and size, pressed into plaster moulds.

Fibrous Plaster is plaster of Paris in a thin coat laid on canvas strained on framework.

Some of the Physical Properties of Metals—Compiled from the Best Authorities.

| Common Name, | Chemical Name, | Initial. | Atomic Weight, | Specific Gravity, | Wt. of Cu in 100 parts of Gum. | Wt. of Cu in 100 parts of Food. | Heat of Combustion, | Specific Heat, | Melting Point F. | Conductivity of Electricity. | Expansion 32 to 100° F. | Hardness, the Diamond—100. | Dissolving 32 to 100° F. | Malleability, 1. | Approximate Atomic weight of Metallic per 100. | |
|---------------------|----------------------|----------|----------------|-------------------|-----------------------------------|------------------------------------|---------------------|----------------|------------------|---------------------------------|----------------------------|-------------------------------|-----------------------------|------------------|--|----------|
| | | | | | | | | | | | | | | | | |
| Hydrogen | Same | H. | 1. | 2.56 | .0924 | 159.005 | 1160 | .21 | 31.33 | ..... | ..... | ..... | ..... | ..... | ..... | \$ 16.30 |
| Aluminum | Same | Al. | 27.3 | 6.71 | .212 | 118.402 | 812 | .0508 | 4.6 | 4.6 | ..... | ..... | ..... | ..... | ..... | 0.36 |
| Antimony | Stibium | Sb. | 122.0 | 5.823 | .354 | 612.513 | 510 | .0308 | 1.8 | 1.1 | .004 | ..... | 10.035 | ..... | ..... | 1.95 |
| Bismuth | Same | Bi. | 207.5 | 8.60 | .31 | 536.253 | 500 | .0567 | 20.06 | ..... | .0094 | 760 | 8.217 | ..... | ..... | 3.26 |
| Cadmium | Same | Cd. | 111.6 | 8.82 | .318 | 549.971 | 4930 | .093 | 74.8 | 91.1 | .0051 | 1360 | ..... | 6 | 3 | 0.22 |
| Copper | Cuprum | Cu. | 63.3 | 19.32 | .697 | 1224.639 | 1915 | .0324 | 54.8 | 73.0 | ..... | 973 | ..... | 1 | 1 | 239.72 |
| Gold | Aurum | Au. | 196.7 | 22.42 | .809 | 1392.399 | 4500 | .0326 | ..... | ..... | ..... | 984 | ..... | ..... | ..... | 466.59 |
| Indium | Same | Ir. | 55.9 | 7.8 | .281 | 186.369 | 3060 | .1138 | 10.1 | 15.5 | .0035 | 1375 | ..... | 4 | 8 | 0.015 |
| Iron | Ferrum | Fe. | 206.4 | 11.37 | .110 | 708.976 | 625 | .0314 | 7.9 | 7.6 | .0081 | 570 | 10.370 | 9 | 6 | 0.06 |
| Lead | Plumbum | Pb. | 23.91 | 1.74 | .628 | 89.791 | 1200 | .25 | 34.3 | ..... | .0083 | 726 | ..... | ..... | ..... | 45.30 |
| Magnesium | Same | Mg. | 58.8 | 8.0 | .289 | 498.84 | 3120 | .122 | ..... | ..... | ..... | 1456 | ..... | ..... | ..... | 108.72 |
| Manganese | Same | Mn. | 199.8 | 13.58 | .190 | 816.781 | 39 | .0347 | 1.3 | ..... | .0182 | 0 | ..... | ..... | ..... | 1.00 |
| Mercury | Hydargyrum | Hg. | 58.6 | 8.80 | .318 | 551.812 | 3000 | .109 | ..... | 13.1 | .0038 | 1110 | ..... | 5 | 9 | 3.80 |
| Nickel | Same | Ni. | 196.7 | 21.50 | .777 | 155.887 | 3200 | .0321 | 9.4 | 16.6 | .0027 | 1107 | ..... | 3 | 5 | 122.31 |
| Platinum | Same | Pt. | 39.04 | .875 | .0316 | 51.561 | 110 | .166 | ..... | ..... | ..... | 230 | ..... | ..... | ..... | 22.65 |
| Potassium | Kalium | K. | 107.66 | 10.53 | .38 | 656.598 | 1750 | .056 | 100.00 | 100.0 | .0056 | 930 | ..... | 2 | 2 | 18.60 |
| Silver | Argentum | Ag. | 23.0 | .9735 | .035 | 60.503 | 170 | .293 | 36.5 | ..... | ..... | 400 | ..... | ..... | ..... | 3.26 |
| Sodium | Natrium | Na. | ..... | 7.854 | .283 | 489.736 | 2550 | .1165 | 11.6 | 12.0 | ..... | ..... | ..... | ..... | ..... | 0.025 |
| Steel | Same | Sn. | 117.8 | 7.293 | .263 | 151.754 | 440 | .055 | 15.4 | 11.4 | .0069 | 651 | 7.025 | 8 | 4 | 0.25 |
| Tin | Same | Zn. | 61.9 | 7.14 | .258 | 441.215 | 780 | .096 | 36.0 | 29.0 | .0088 | 1077 | 6.480 | 7 | 7 | 0.10 |

LAW OF SPECIFIC HEAT—In order to raise the temperature of different bodies the same number of thermometric degrees very different amounts of heat are required. The atoms of the solid element possess sensibly the same specific heat.

Ductility—The property of being drawn into wire or threads.

PLANS, SPECIFICATIONS AND ESTIMATES.

NOMENCLATURE OF DRAWINGS.

FILE 892

GENERAL SYMBOLS.

In response to a request sent out to a large number of prominent architects to send in copies of nomenclature used on their drawings, it was found that this varied with practically every architect, the result being that contractors estimating in different offices are compelled to memorize a large number of different systems of notation before being able to read plans intelligently; same rule applies to draughtsmen going from one office to another, all of which causes much waste of time and greatly increases the possibility of error. With this as an excuse we offer the following series of symbols, selected from the various systems with the hope that it will be generally adopted and thus bring about a greater uniformity of drawing nomenclature. The lighting symbols are taken from the standard symbols for wiring plans, prepared by the National Electrical Contractors Association of the United States. The structural iron symbols are taken from the Osborne system of nomenclature most generally used by structural iron contractors. General symbols are collated from various sources.

LIGHTING SYMBOLS.

- ④ CEILING OUTLET-ELECTRIC ONLY. NUMERAL IN CENTER INDICATES NO. OF STANDARD 16 C.P. INCAND. LAMPS.
- ④ $\frac{1}{2}$ CEILING OUTLET COMBINATION. $\frac{1}{2}$ INDICATES 4-16 C.P. INCANDESCENT LAMPS & 2 GAS BURNERS
- ② BRACKET OUTLET-ELECTRIC ONLY. NUMERAL INDICATES NO. OF STANDARD 16 C.P. INCAND. LAMPS.
- ④ $\frac{1}{2}$ BRACKET OUTLET COMBINATION. $\frac{1}{2}$ INDICATES 4-16 C.P. INCANDESCENT LAMPS & 2 GAS BURNERS
- ② WALL OR BASE BOARD RECEPTACLE OUTLET. NUMERAL IN C. INDICATES NO. OF STD. 16 C.P. INCAND. LAMPS.
- ④ FLOOR OUTLET. NUMERAL IN C. INDICATES NO. OF STD. 16 C.P. INCAND. LAMPS
- BELL OUTLET
- BUZZER OUTLET
- △ SPECIAL OUTLET, FOR LIGHTING, HEATING & POWER CURRENT AS DESCRIBED IN SPECIFICATIONS.
- TELEPHONE OUTLET-PRIVATE SERVICE
- PUBLIC SERVICE
- ▲ SPEAKING TUBE
- DOOR OPENER
- ④ CEILING OUTLET, GAS ONLY. NUMERAL INDICATES NO. OF GAS BURNERS
- ② BRACKET OUTLET " " " "
- ④ F OUTLET FOR FUEL GAS

- ④ 8×10 GIRDER. NUMERAL INDICATES SIZE, ENCLOSED NUMERAL INDICATES PARTICULAR GIRDER
- ④ SIZE HERE COLUMN, SMALL NUMERAL INDICATES NUMBER OF PARTICULAR COLUMN
- ④ 25 DOOR, SMALL NUMERAL INDICATES NUMBER OF PARTICULAR DOOR
- ④ 15 WINDOW, SMALL NUMERAL INDICATES NUMBER OF PARTICULAR WINDOW
- ④ 3 INDICATES DESIGNATING NUMBER OF ROOM
- ④ $\frac{1}{2}$ ELEVATION OF POINT. SMALL NUMERALS INDICATE DISTANCE ABOVE ZERO POINT IF PRECEDED BY - REFERRED TO POINT BELOW ZERO
- ||||| BRICK
- ||||| CONCRETE
- ||||| WALLS WITH WOOD FURRING & LATH & PLASTER
- ||||| METAL
- ||||| TILE & PLASTER
- ||||| HOLLOW TILE CONSTRUCTION
- ||||| WALL OF WOOD STUDS & LATH & PLASTER
- ||||| STONE
- ||||| RUBBLE
- ||||| RUBBLE STONE
- ④ R DIMENSION STONE
- ④ D ASHLAR STONE
- ④ A DRESSED ASHLAR
- ④ AF ROCK FACED ASHLAR
- ④ Ad ANY STONE DRESSED
- ④ N NOT DESCRIBED. SMALL NUMERALS REFER TO DETAILS & SPECIFICATIONS
- — — STORM SEWER
- — — DRAINAGE SYSTEM
- — — SANITARY SEWER

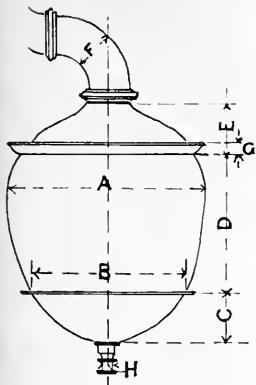
SYMBOLS FOR HEATING PLANS.

- ④ R SMALL NUMERAL DESIGNATES PARTICULAR RISER. ARROW LOCATES SAME & INCH FIGURE GIVES SIZE.
- ④ R SMALL NUMERAL DESIGNATES PARTICULAR RADIATOR.
- ④ R SMALL NUMERAL IN INCHES GIVES SIZE AND ARROW LOCATES FEED
- — — RETURN
- — — INDICATES DIRECTION OF FLOW
- — — HOT AIR
- ④ R 12x14 ENCLOSED NUMERAL INDICATES PARTICULAR REGISTER. INCHES INDICATE SIZE.
- ④ R 12 INCHES INDICATES NO. OF LEADERS. INCHES INDICATE INTERIOR DIAMETER. ARROW INDICATES DIRECTION OF FLOW
- ④ R 3 $\frac{1}{2}$ x 1 $\frac{1}{2}$ SMALL NUMERAL INDICATES NO. OF PARTICULAR STACK. INCHES INDICATE SIZE

TABLE OF TREADS AND RISES.

RULE FOR CALCULATING PROPORTIONED WIDTH AND HEIGHT OF TREADS AND RISES OF STAIRS.

Subtract the width of the head from 25 in. and the result will be twice the height of the disc; thus: if the tread is 10 in. wide, then $25 - 10 = 15$; $15 \div 2 = 7\frac{1}{2}$ in. is the height of either portion of the tread; this is exclusive of nosings.



Memoranda for Breweries
Kettle Measures

| Barrels | A | B | C | D | E | F | G | H |
|---------|--------|--------|--------|--------|--------|-------|-----|----|
| 50 | 8' 6" | 7' | 2' | 5' | 2' | 2' | 6" | 3" |
| 100 | 10' 6" | 8' 6" | 2' 6" | 6' | 2' 6" | — | 8" | 4" |
| 150 | 11' 6" | 9' 3" | — | 7' 6" | — | 2' 6" | — | — |
| 200 | 12' 6" | 10' | 2' 10" | 8' 6" | 2' 10" | — | 10" | 5" |
| 250 | 13' 6" | 10' 6" | 3' | 9' 6" | 3' | — | — | — |
| 300 | 11' 6" | 11' | — | 10' | — | 3' | 12" | — |
| 350 | 15' | 11' | 3' 6" | 10' 6" | 4' | — | — | — |
| 400 | 16' | 12' | 4' | 11' | — | — | — | — |

Capacities for Appliances

| Kettle | 50 barrels | 100 barrels. | 150 barrels. | 200 barrels. | 250 barrels | 300 barrels | 400 barrels. |
|----------------------------|-----------------------|-----------------------|------------------------|--------------------------|-----------------------|--------------------------|--------------------------|
| Marl-tub | 11' x 5' | 12' x 6' | 14' x 6' | 15' x 6' 6" | 16' x 6' | 17' x 7' | 18' x 7' |
| Hop-jacket | 7' x 8' x 5' | 8' x 9' 6" | 10' x 12' 6" | 11' 11' x 6' | 12' 14' x 6" | 14' 15' x 7' | 14' 15' x 7' 6" |
| Meal hopper | 8' x 4' x 4' | 8' x 6' 4' | 9' x 7' 4' 6" | 10' 7' 6" x 5' | 10' 8' 5' | 11' 8' 5' 6" | 12' 10' 6' |
| Beer tank | 8' 6" x 5' | 10' 6" | 12' 6" | 14' 6" | 15' 6" | 16' x 6" | 18' 7" |
| Water tank | 8' x 8' 95 bar | 10' x 9' 165 bar | 12' x 9' 240 bar | 13' 10' 315 bar | 14' 10' 6' 380 bar | 15' 11' 400 bar | 16' 13' 600 bar |
| Bandt cooler Lengths of | 27 tubes 14 long | 37 tubes 16 long | 42 tubes 18 long | 42 tubes 18 long | 42 tubes 20 long | 48 tubes 20 long | 2ea 42 tubes 18 long |
| Grain tank hopper | 6' x 6' x 3' 6" 4' | 8' x 8' x 4' 6" 3' | 8' x 10' x 5' 3' 6" | 10' 10' x 5' 6" 3' 6" | 10' 12' x 6" 6' 0" | 11' 6' x 13' 6" 6' 0" | 12' 7' x 15' 7" 7' 0" |

Size of Swimming Tank.

FILE 725.74

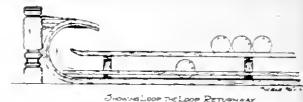
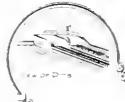
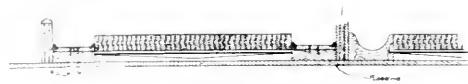
Swimming tanks that can be used for swimming contests must be exactly 20 yards in interior length, no more no less. (A tank $\frac{1}{2}$ inch short would be ruled out of contest.) Eight yards wide is best, although 7 yards will pass; 4 feet deep at shallowest point and 8 feet deep at deepest point, which deepest point should be about 12 feet from end where springboard is placed. Depth at springboard end should be six feet. Interior of tank, both sides and bottom should be white, and there should be three black lines on the bottom extending parallel with sides, and dividing the tank into four equal alleys; there should be a line across tank on bottom and up sides at exactly 2 yards from each end, measured horizontally, making lines exactly 16 yards apart horizontally.

Size of the Billiard Room, Gas Light, Etc.

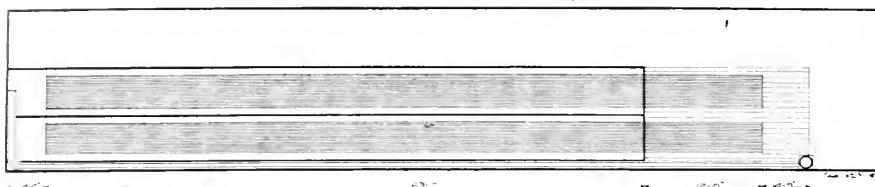
The space required for the different sized tables is as follows:

- For table 6 x 12.....Room should be 16 x 22
- For table 5 $\frac{1}{2}$ x 11.....Room should be 15 $\frac{1}{2}$ x 21
- For table 5 x 10.....Room should be 15 x 20
- For table 4 $\frac{1}{2}$ x 9.....Room should be 14 x 18 $\frac{1}{2}$
- For table 4 x 8.....Room should be 13 x 17
- For table 3 $\frac{1}{2}$ x 7.....Room should be 12 $\frac{1}{2}$ x 16

The following directions for arranging the lights over billiard tables will be found useful. The distance of the light from the floor should be about 6 feet 2 inches. For a 5 $\frac{1}{2}$ by 11 table, cross-arms 31 inches and long arms 62 inches. For a 5 by 10 table, the cross-arms of the pendant should measure, from light to light, 28 inches and the long arm 56 inches. For a 4 $\frac{1}{2}$ by 9 table, cross-arms 25 inches and long arms 50 inches. For a 4 by 8 table, cross-arms 22 inches and long arms 44 inches.



SHOW-HOOF THE DOOR RETURN WAY



Important Points in Figuring Dimensions of a Stable.

FILE 728.942

The proper height and width of a stable door is not less than nine feet square. Width and height of vehicles is as follows:

| | Height. Ft. In. | Length. Ft. | Width. Ft. In. |
|-----------------------|--------------------|----------------|-------------------|
| Brougham | 7 0 | 11 | 6 0 |
| Rockaway | 7 0 | 11 | 6 0 |
| Victoria | 7 6 | 12 | 6 0 |
| Phaeton | 8 6 | 10 | 6 0 |
| Berlin Coach | 7 6 | 13 | 6 6 |
| Landau | 7 6 | 13 | 6 6 |
| Body brake | 9 0 | 11 | 7 0 |
| Goddard phaeton | 8 0 | 9 | 6 0 |
| Stanhope | 8 0 | 9 | 6 0 |
| Buggy | 9 0 | 9 | 6 0 |
| Single trap | 6 0 | 9 | 6 0 |
| Mail coach | 9 0 | 15 | 7 6 |
| Omnibus | 8 0 | 11 | 7 0 |

Horse Stalls.—Width, 3 feet 10 inches to 4 feet, or over 5 feet in width and 9 feet long. Width should not be between 4 and 5 feet, as in such cases the horse is liable to cast himself.

| Spec. No. | No. of Stalls. | From Back to Front Line of Case. | Width of Space Required. | Height Required for Swell-Box and Large Pipes. | Spec. No. | No. of Stalls. | From Back to Front Line of Case. | Width of Space Required. | Height Required for Swell-Box and Large Pipes. |
|-----------|----------------|--|-----------------------------|--|-----------|----------------|--|-----------------------------|--|
| 10 | 7' 4" | 11' 6" | 12' 6" | 20 | 21 | 12' 9" | 15' 6" | 17' | |
| 11 | 8' | 11' 6" | 12' 6" | 22 | 22 | 13' 4" | 15' 6" | 17' | |
| 12 | 8' | 12' 6" | 12' 6" | 23 | 23 | 13' 6" | 15' 6" | 17' | |
| 13 | 8' 7" | 12' 6" | 12' 6" | 25 | 24 | 14' | 15' 6" | 17' | |
| 14 | 9' 3" | 12' 6" | 12' 6" | 26 | 25 | 14' 6" | 15' 6" | 17' | |
| 15 | 10' 5" | 12' 6" | 12' 6" | 28 | 26 | 14' 6" | 15' 6" | 17' | |
| 16 | 11' 1" | 14' 8" | 17' | 29 | 27 | 14' 6" | 16' 4" | 17' 6" | |
| 17 | 11' 7" | 14' 8" | 17' | 31 | 28 | 15' | 16' 4" | 17' 6" | |
| 18 | 12' 2" | 14' 8" | 17' | 32 | 29 | 15' 6" | 16' 4" | 17' 6" | |
| 19 | 12' 9" | 14' 8" | 17' | 34 | 30 | 15' 6" | 17' | 17' 6" | |

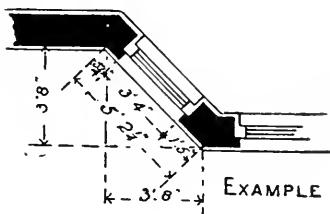
Add 40" more from Front Line of Case for Keydesk Pedals and Seat.

Sizes of Piano.

7 1/3 Octaves.

| | | Height. | Length. | Width. |
|--------------------------|-------|-------------|-------------|--------------|
| Upright..... | about | 4 ft. 3 in. | 5 ft. 4 in. | 2 ft. 3 in. |
| Small or Baby Grand..... | about | 3 ft. 2 in. | 6 ft. 0 in. | 4 ft. 10 in. |
| Parlor Grand..... | about | 3 ft. 2 in. | 7 ft. 6 in. | 5 ft. 0 in. |

Table Showing the Length of Sides of Bays, Angle being 45 Degrees.



| | | | | | | | | | | | | | | | |
|-------|-------|----------|-------|------|-------|---------------------|--------------------|--------|----------|--------|------|-------|---------------------|-----|--------------------|
| 1 ft. | 6 in. | by 1 ft. | 6 in. | .... | 2 ft. | 1 $\frac{7}{8}$ in. | 2 ft. | 10 in. | by 2 ft. | 10 in. | .... | 4 ft. | 0 $\frac{1}{8}$ in. | | |
| 1 " | 7 " | " | 1 " | 7 " | .... | 2 " | 2 $\frac{7}{8}$ " | 2 " | 11 " | " | 2 " | 11 " | .... | 4 " | 1 $\frac{1}{2}$ " |
| 1 " | 8 " | " | 1 " | 8 " | .... | 2 " | 4 $\frac{1}{4}$ " | 3 " | 0 " | " | 3 " | 0 " | .... | 4 " | 2 $\frac{5}{8}$ " |
| 1 " | 9 " | " | 1 " | 9 " | .... | 2 " | 5 $\frac{1}{8}$ " | 3 " | 1 " | " | 3 " | 1 " | .... | 4 " | 4 $\frac{5}{8}$ " |
| 1 " | 10 " | " | 1 " | 10 " | .... | 2 " | 7 $\frac{1}{8}$ " | 3 " | 2 " | " | 3 " | 2 " | .... | 4 " | 5 $\frac{3}{4}$ " |
| 1 " | 11 " | " | 1 " | 11 " | .... | 2 " | 8 $\frac{1}{2}$ " | 3 " | 3 " | " | 3 " | 3 " | .... | 4 " | 7 $\frac{1}{8}$ " |
| 2 " | 0 " | " | 2 " | 0 " | .... | 2 " | 9 $\frac{1}{8}$ " | 3 " | 4 " | " | 3 " | 4 " | .... | 4 " | 8 $\frac{1}{8}$ " |
| 2 " | 1 " | " | 2 " | 1 " | .... | 2 " | 11 $\frac{3}{8}$ " | 3 " | 5 " | " | 3 " | 5 " | .... | 4 " | 10 " |
| 2 " | 2 " | " | 2 " | 2 " | .... | 3 " | 0 $\frac{3}{4}$ " | 3 " | 6 " | " | 3 " | 6 " | .... | 4 " | 11 $\frac{3}{8}$ " |
| 2 " | 3 " | " | 2 " | 3 " | .... | 3 " | 2 $\frac{3}{8}$ " | 3 " | 7 " | " | 3 " | 7 " | .... | 5 " | 1 $\frac{5}{8}$ " |
| 2 " | 4 " | " | 2 " | 4 " | .... | 3 " | 3 $\frac{7}{8}$ " | 3 " | 8 " | " | 3 " | 8 " | .... | 5 " | 2 $\frac{1}{4}$ " |
| 2 " | 5 " | " | 2 " | 5 " | .... | 3 " | 5 " | 3 " | 9 " | " | 3 " | 9 " | .... | 5 " | 3 $\frac{5}{8}$ " |
| 2 " | 6 " | " | 2 " | 6 " | .... | 3 " | 6 $\frac{7}{8}$ " | 3 " | 10 " | " | 3 " | 10 " | .... | 5 " | 5 $\frac{1}{8}$ " |
| 2 " | 7 " | " | 2 " | 7 " | .... | 3 " | 7 $\frac{7}{8}$ " | 3 " | 11 " | " | 3 " | 11 " | .... | 5 " | 6 $\frac{1}{2}$ " |
| 2 " | 8 " | " | 2 " | 8 " | .... | 3 " | 9 $\frac{1}{4}$ " | 4 " | 0 " | " | 4 " | 0 " | .... | 5 " | 7 $\frac{7}{8}$ " |
| 2 " | 9 " | " | 2 " | 9 " | .... | 3 " | 10 $\frac{1}{6}$ " | | | | | | | | |

TO FIND THE RADIUS OF AN ARCH.

Centers—The following is the method to find the radius for arch centers S = span R = rise
 Then
$$\left\{ \frac{\left(\frac{S}{2}\right)^2}{R} + R \right\} \div 2$$
 or: To the square of half the span divided by the rise, add the rise and divide this sum by 2, and the result will be the radius required.

Example:—Suppose an arch 20 feet span and 5 feet rise then:

$$\left\{ \frac{10^2}{5} + 5 \right\} \div 2 = \frac{20 + 5}{2} = 12 \text{ ft. 6 in. the radius required.}$$

TO FIND AREA OF CIRCLE.

FILE 692.1

When finding the area of a circle in the usual way by squaring the diameter and multiplying by .7854, four multiplications are required, one for each digit. The following method requires only one. Example: To find the area of a circle of 3.7 inches diameter, $3.7 \times 3.7 = 13.69$. Then

13.69 As will be readily seen, this sum consists in multiplying the top line by .7854 seven, repeating one place to the right, doubling the above, and repeating ————— as before. It may be proved thus:

$$\begin{array}{r}
 9583 \\
 9583 \\
 19166 \\
 19166 \\
 \hline
 10.752126
 \end{array}
 \quad
 \begin{array}{r}
 7 \\
 7 \\
 14 \\
 14 \\
 \hline
 7854
 \end{array}$$

If the proof only is memorized the method is fixed in the brain forever.

MASONRY, PLASTERING AND FIREPROOFING.

WEIGHT OF BRICKWORK.

FILE 693.2

Placing the weight of brickwork at 112 lb. per cubic foot, the weights per superficial foot for different walls are:

| | |
|-------------------|---------|
| 9 inch wall..... | 84 lb. |
| 13 inch wall..... | 121 lb. |
| 18 inch wall..... | 168 lb. |
| 22 inch wall..... | 205 lb. |
| 26 inch wall..... | 243 lb. |

MEASUREMENT OF OLD BRICK.

Uncleaned rough from building dumped from 8 to 10 bricks per cubic foot, or average of 111 cubic feet to the M.

Uncleaned stacked on outside and interior of stack filled promiscuously 10-12 per cubic feet, or average of 91 cubic feet to the M.

Cleaned and closely stacked, 16 to 18 bricks per cubic foot, or actual average of 59 cubic foot to M. (Usually sold at 60 cubic feet to M to allow for waste and poor piling.)

Cleaned stacked on outside and interior filled promiscuously, 12 to 14 per cubic foot, or actual average of 77 cubic feet to M. (When sold from pile measure customary to count 80 cubic feet to M, to allow for waste and bats.)

Measurement of New Brick Work.

The Chicago Masons and Builders' Association have arbitrarily assumed that a cubic foot of wall contains 22½ common brick, or 7½ brick to the superficial foot of 4-inch wall and 15 brick to the superficial foot of 8-inch wall. These figures of the Mason's and Builders' Association are frequently used for the appraisal of party walls, etc., but if so used, the price per M for work in wall should be reduced accordingly.

The actual number of Chicago common brick required for a cubic foot of solid wall varies from 17½ to 19½, and masons in purchasing brick usually reserve 18 brick per cubic foot of solid wall, and when so doing, rarely find an excess or shortage at the end of construction. When the walls are divided into many small piers, requiring much cutting, and consequently much waste, it is best to figure 20 brick to the cubic foot.

On account of the wide variance of practice on the part of masons in estimating, architects, when calling for estimates on brick work by the thousand, will avoid useless controversy by stipulating that quantity of brick will be determined by superficial wall measurement according to the following rule, which is very nearly correct, as Chicago brick now run. Divide the total number of superficial feet of wall surface of a given thickness by 160, and multiply the result by the number of brick widths the wall is thick, and the result will equal the number of thousands of brick contained. A four-inch wall will contain 6¾ brick to the superficial foot, or 1,000 brick to 160 square feet.

Miscellaneous Masonry Data.

A fireproof floor constructed of iron beams and four-inch brick arches will weigh from 65 to 75 pounds per superficial foot.

The safe and proper bearing of joist, timber and girders supporting a floor should not exceed ten tons on brick walls and fourteen tons on good stone walls.

A fireproof floor constructed of iron beams and of iron arches made of No. 18 iron, and filled in on top with concrete or slag and cement, will weigh about the same as brickwork four inches thick.

Lath and plastering, two-coat work, weighs from 9 to 12 pounds per superficial foot.

One hundred yards of plastering will require fourteen hundred laths, four and a half bushels of lime, four-fifths of a load of sand, nine pounds of hair and five pounds of nails, for two-coat work.

A load of mortar measures a cubic yard, requires a cubic yard of sand and nine bushels of lime, and will fill thirty hods.

A bricklayer's hod measuring one foot four inches by nine inches, equals 1,296 cubic inches in capacity, and contains twenty bricks.

A single load of sand or other materials equals a cubic yard.

FRAMED AND BOXED CONSTRUCTION CARPENTRY, STRUCTURAL AND ORNAMENTAL IRON

By EMERY STANFORD HALL, B. S.

ESTIMATE DATA FOR ORDINARY STEEL AND JOIST CONSTRUCTION.

No hard and fast rule can be laid down for estimating. There are so many practical exigencies which alter assumed or average conditions that experience and judicial capacity are essential to successful estimating. Manifestly a well organized force commanded by men of executive ability can accomplish more and better work in less time and with less waste than a poor organization of inefficient men under incapable direction. Likewise work easily accessible and simple in design can be executed by any force with less waste and in less time than complicated work or work executed at a high altitude, requiring much scaffolding and hoisting apparatus.

FLOOR FRAMING.

The number of joists required is always in excess of the number which would naturally be called for by uniform spacing as indicated in Fig. 1 "Floor Construction, type C." Extra joists have to be put in to form trimmers and headers around chimneys, stair-wells, and other openings in floors. Also, joists should be doubled under partitions with block separators between so as to permit pipes passing through without cutting. These conditions, as illustrated below in Fig. 1, "Type E Floor Construction," show a case where 14 joists are required in only ten uniform spacings, which is extreme, but taking an average of type "E" and type "C," conditions which occur with about equal frequency in buildings of average requirements, it is reasonable to assume that two extra joists will be required for every ten feet.

Number of thousands of board feet in joists for any uniform bent of any building, with any length of joists, when width of bent plus the joist bearing on walls or girders = b ; any stretch or depth of the bent parallel to joist bearings = L ; any uniform distance between centers of joists = s ; and J =

$$\frac{bd}{12}$$

the result:— $J = \frac{12}{1000} \left(\frac{2L}{10} - \frac{L}{s} \right) \cdot \frac{bd}{12} = \frac{bd}{1000} \cdot \frac{1}{10} \left(2 - \frac{L}{s} \right)$ — the

number of board feet of material in a piece of timber (b) thick by (d) in depth and (1) in length, and the values of same for material most generally used are given in table A.

Let $\frac{bd}{12} = B$.

(1.) $J = \frac{B}{1000} \left(\frac{2L}{10} - \frac{L}{s} \right)$. s is commonly equal

either to 1 ft. or $1\frac{1}{2}$ ft. Substituting 1 for value of s = joists placed 12" from C.

(2.) $J = 0.0012 L B$. Substituting $1\frac{1}{2}$ for value of s = joists placed 16" from C.

(3.) $J = 0.00095 L B$.

(4.) $J = 0.0008 L B$.

To find the average amount of material contained in a square of 100 sq. ft. floor construction take a value of B corresponding to $L=10$, and a value of $L=10$ and substitute in either formula (1.), (2.) or (3.) according to spacing desired. The following "Table I" gives the result of such substitution for some of the more commonly used sizes of joists:

TABLE I.

1—10
L—10
Number of M's of bd. ft. in a square of 100 sq. ft. for various joists in construction

| b d | $\frac{10 b d}{12}$ | B | $J \cdot s = 1$ | $J \cdot s = 1\frac{1}{2}$ | $J \cdot s = 2$ |
|-------|---------------------|--------|-----------------|----------------------------|-----------------|
| 2 x 2 | 3.34 | .04008 | .031730 | .06720 | |
| 2 x 4 | 6.67 | .08004 | .063365 | .05336 | |
| 2 x 6 | 10.00 | .12000 | .095000 | .08000 | |
| 2 x 8 | 13.34 | .16008 | .126730 | .10672 | |

| b d | $\frac{10 b d}{12}$ | B | $J \cdot s = 1$ | $J \cdot s = 1\frac{1}{2}$ | $J \cdot s = 2$ | Number of M's of bd. ft. in a square of 100 sq. ft. for various joists in construction. |
|--------|---------------------|----------|-----------------|----------------------------|-----------------|---|
| 2 x 10 | 16.67 | .20004 | .158365 | .13336 | | |
| 2 x 12 | 20.00 | .24000 | .190000 | .16000 | | |
| 2 x 14 | 23.34 | .28008 | .221730 | .18672 | | |
| 2 x 16 | 26.67 | .32004 | .253365 | .21336 | | |
| 3 x 6 | 15.00 | .18000 | .142500 | .12000 | | |
| 3 x 8 | 20.00 | .24000 | .190000 | .16000 | | |
| 3 x 10 | 25.00 | .30000 | .237500 | .20000 | | |
| 3 x 12 | 30.00 | .36000 | .285000 | .21000 | | |
| 3 x 14 | 35.00 | .42000 | .332500 | .25000 | | |
| 3 x 16 | 40.00 | .48000 | .380000 | .32000 | | |
| 4 x 4 | 13.34 | .16008 | .126730 | .10672 | | |
| 4 x 6 | 20.00 | .24000 | .190000 | .16000 | | |
| 4 x 8 | 26.67 | .32004 | .233365 | .21336 | | |
| 4 x 10 | 33.34 | .40008 | .316730 | .26672 | | |
| 4 x 12 | 40.00 | .48000 | .380000 | .32000 | | |
| 4 x 14 | 46.67 | .56004 | .443365 | .37336 | | |
| 4 x 16 | 53.34 | .64008 | .506730 | .42672 | | |
| COL. I | COL. II | COL. III | COL. IV | COL. V | | |

Col. I gives size of joists or sticks of timber. Col. II gives the number of board feet in a stick of the size given in Col. I and 10 ft. long. Col. III gives the amount of M of bd. ft. of framing material contained in a square of 100 sq. ft. for joists of the size given in Col. I when these joists are placed 12" from centers; Col. IV when placed 16" from centers; Col. V when placed 20" from centers.

Bridging where placed 8 ft. on centers requires 12 pairs to the square where joists are placed 12" from centers; 9 $\frac{1}{2}$ pair where joists are placed 16" from centers.

PARTITION CONSTRUCTION.

The amount of material and labor involved in the various types of ordinary stud partitions is practically uniform for a given height of partition, spacing of studs and size of same. See types "F" and "G" in illustration below. Type "F" has two layer bottom plate or shoe, 1 line of block-bridging and a single layer top-plate, while type "G" has two layer bottom-plate or shoe and two layer cap-plate with no block-bridging, giving the same actual amount of material. Stud partitions are usually spaced out and studs set on uniform spacing, regardless of openings; then the openings are cut and the studs around same doubled, requiring extra studs, as the posts at sides of openings rarely happen to fall on the line with studs originally placed. Door opening Fig. 1, type "A" is usual condition. Door opening Fig. 1, type "B," where both posts fall in line with studs as first set, is a type which almost never occurs in actual practice and so cannot be considered as a possible saving on material. "Section AA," Fig. 1, shows connecting partitions from various directions and makes clear the necessity for extra studs above the number required for regular spacing to provide for angles. It will be seen that every angle requires from 2 to 4 extra studs. The pieces of studs cut out for openings are used for doubling, but there are not sufficient to supply all extra studing needed.

Number of thousands of board feet in studs for any partition with any length of studs, when length of studs between shoe and cap-plate = h ; any length of partition measured in the horizontal direction and through all angles, so as to increase the actual length of partition by the thickness of same at angles = L ; any uniform distance between centers of studs = s ; and Q = the result:

Observing Fig. 1, it will be seen that average value of $Q = \left[\frac{\left(\frac{L}{s} + \frac{8L}{10} \right) h + 4L}{1000} \right] \frac{\text{ft.}}{12} \cdot \frac{\text{ft.}}{14}$

the number of board feet of material in a piece of timber or stud; (f) face by (t) thickness and one ft. in length and the values of same for sizes of material most generally used are given in Table II, Col. II. Let $\frac{ft}{in.} \cdot F$.

$$(5.) \quad Q = F \left[\frac{\left(\frac{L}{s} + \frac{8L}{10} \right)h + 4L}{1000} \right]. \quad s \text{ is com-}$$

monly equal either to 1 or $1\frac{1}{3}$, sometimes $1\frac{2}{3}$. Substituting 1' for value of $s =$ studs placed 12" from C.

$$(6.) \quad Q = \left(\frac{1.8Lh + 4L}{1000} \right) F.$$

TABLE II.

| Size of studs | L = 10 | 12' spacing | 16' spacing | 20' spacing |
|------------------|-------------|-----------------------------------|--|--|
| f x t | ft 12' F | Q _{h=10'} ^{s=1} | Q _{h=10'} ^{s=1 1/4'} | Q _{h=10'} ^{s=1 1/2'} |
| 1" x 1" | .084 | .01848 | .016380 | .01512 |
| 1 x 2 | .167 | .03674 | .03240 | .30066 |
| 2 x 2 | .334 | .07348 | .06480 | .60612 |
| 2 x 3 | .500 | .11000 | .09750 | .90000 |
| 2 x 4 | .667 | .14674 | .11027 | .12006 |
| 2 x 6 | 1.000 | .22000 | .19500 | .18000 |
| 2 x 8 | 1.334 | .29348 | .26013 | .24012 |
| 3 x 4 | 1.000 | .22000 | .19500 | .18000 |
| 3 x 6 | 1.500 | .33000 | .29250 | .27000 |
| 3 x 8 | 2.000 | .44000 | .38000 | .36000 |
| 4 x 4 | 1.334 | .30448 | .26013 | .24012 |
| 4 x 6 | 2.000 | .440000 | .39000 | .36000 |
| 4 x 8 | 2.667 | .58675 | .52007 | .48006 |
| COL. I | COL. II | COL. III | COL. IV | COL. V |

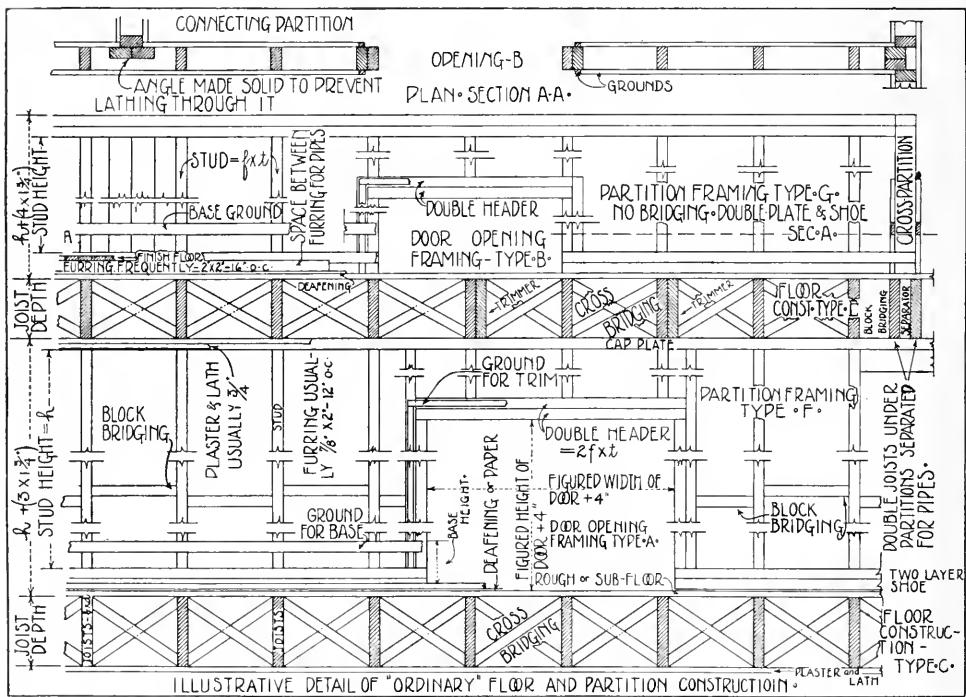


Fig. 1.

Substituting $1\frac{1}{3}$ ' for value of s = studs spaced 16" from c.

$$(7.) \quad \left(\frac{1.55Lh + 4L}{1000} \right) F.$$

Substituting $1\frac{2}{3}$ ' for value of $s =$ studs spaced 20" from c.

$$(8.) \quad \left(\frac{1.4Lh + 4L}{1000} \right) F.$$

To find the average number of M's of bd. ft. of framing material contained in a square of 100 sq. ft. of partition construction take a value of F corresponding to size of studs used (see Col. II, Table II below) and a value of $L = 10$ and substitute in either formula (5.), (6.), (7.) or (8.), according to spacing desired. This really will give a partition three or four \times f greater in one dimension than 10 ft., but this should be allowed extra for places where the material will not cut to advantage. The following Table II gives the result of such substitution for some of the more commonly used sizes of joists. (6.) becomes $Q = .22 F$; (7.) becomes $Q = .195 F$; (8.) becomes $Q = .18 F$.

Col. I gives sizes of studs or furring strips. Col. II gives the number of board feet in a stick of the size given in Col. I and one ft. long. Col. III gives the number of M's of bd. ft. of framing material contained in a square of 100 sq. ft. of stud partition or furring, including extras and waste if constructed of studs of the size indicated in Col. I and spaced 12" from centers; Col. IV, spaced 16" from centers; Col. V, spaced 20" from centers.

Grounds are usually placed for nailing base-boards, dado-caps, and trim around openings. These are sometimes made 1" x 1" and sometimes 1" x 2" and are put up on both sides of partitions.

Number of thousands of board feet in grounds for a partition of any length and height = $G = \frac{(4L+5hO)}{1000}$. F when O = the number of openings and can be assumed to average $\frac{L}{10}$:

$$(9.) G = \left(\frac{4L + 5Lh}{1000} \right) F.$$

For one square $L = 10$, $h = 10$, then $G = .09$ F. Value of F can be substituted from Table II, Col. II.

For $1'' \times 1''$ grounds $G = .00750$ M; for $1'' \times 2''$ $G = .01503$ M bd. ft.

EXTERIOR WALL CONSTRUCTION.

Frame exterior wall construction is so similar to interior stud partition construction that for purposes of estimating quantity of material to determine cost Table II may be used for estimating this work.

Furring is applied to exterior masonry walls, usually $1'' \times 2''$ spaced either $12''$ or $16''$ from centers; similar furring is sometimes applied to the under side of joists to receive lath and also on top of rough floors to afford space for pipes; but here it is frequently $2'' \times 2''$. Not as much extra furring is actually put into the building as extra studs estimated in Table II, but there is so much waste of this material that amounts given in Table II should be used in estimating.

Coverings of Partitions, Walls, Floors and Ceilings are measured by the surface area of each layer. Most such material is either lapped, matched or otherwise cut to waste, so that the surface area purchased will not cover the same amount of frame surface. This varies with different materials and the following table gives values of the factor W , by which the actual measurement of surfaces must be multiplied to determine the amount of material which must be purchased.

TABLE III.

| | |
|------------|---|
| $W = 1$ | for plain boards laid close. |
| $W = .65$ | for $1'' \times 4''$ battens placed $6''$ from c. |
| $W = .75$ | for $1'' \times 6''$ battens placed $8''$ from c. |
| $W = 1.13$ | for $6''$ to $8''$ D. and M. flooring or sheathing. |
| $W = 1.19$ | for $4''$ D. and M. flooring or ceiling. |
| $W = 1.25$ | for $3''$ D. and M. flooring or ceiling. |
| $W = 1.34$ | for $2''$ D. and M. flooring. |
| $W = 1.75$ | for $1\frac{1}{2}''$ D. and M. flooring. |
| $W = 1.30$ | for $6''$ siding $4\frac{1}{4}$ to weather. |
| $W = 1.38$ | for $4''$ siding $2\frac{1}{2}$ to weather. |
| $W = 1$ | For most felts and papers as these are usually listed for enough less than the roll actually contains to allow for lapping. |

LABOR.

Wages for labor are paid by the hour and are governed by union scales. Let hourly wage $H = 60$ in Chicago at this time.

Labor required to place and finish material is usually approximated either by the time required to erect a square of surface of framing for partitions, walls, floors, or of layers of covering, or by the time required to place one M bd. ft. of material or M sq. ft. of surface in the case of sheet coverings. The latter method is the more practical and involves less work in estimating, as these quantities have to be determined in estimating the material.

The following table gives the approximate number of hours it will take an average mechanic to place one thousand (M) board feet or surface feet of material of the various sorts and for various purposes enumerated.

TABLE IV.

| | |
|---|--------------------------------|
| Framing Stuff. | Hours required to place 1 M. |
| $2'' \times 3''$ studs | require 35 hours to place 1 M. |
| $2'' \times 4''$ and $2'' \times 6''$ studs | require 32 hours to place 1 M. |
| $2'' \times 8''$ studs | require 30 hours to place 1 M. |
| $1'' \times 1''$ grounds | require 83 hours to place 1 M. |
| $1'' \times 2''$ grounds and furring | require 64 hours to place 1 M. |
| $2'' \times 2''$ grounds and furring | require 50 hours to place 1 M. |

| | |
|---|---|
| $1'' \times 8''$ to $10''$ sheathing | require 30 hours to place 1 M. |
| $1'' \times 4''$ roof sheathing or slats | require 26 hours to place 1 M. |
| $1'' \times 6''$ roof sheathing or slats | require 26 hours to place 1 M. |
| Shingles laid $4\frac{1}{2}''$ to W. | require 5.8 hours to place 1 M. |
| 1000 sq. ft. paper or felt | require $\frac{3}{4}$ hours to place 1 M. |
| $1'' \times 8''$ and $1'' \times 6''$ D. & M. sheathing | require 25 hours to place 1 M. |
| $1'' \times 4''$ D. & M. sheathing | require 26 hours to place 1 M. |
| $2'' \times 4''$ and $2'' \times 6''$ D. & M. sheathing | require 20 hours to place 1 M. |
| $3'' \times 4''$ D. & M. sheathing | require 14 hours to place 1 M. |
| $3'' \times 6''$, $3'' \times 8''$, $4'' \times 4''$ and $4'' \times 6''$ D. & M. sheathing | require 16.6 hours to place 1 M. |
| $4'' \times 8''$ D. & M. sheathing | require 15 hours to place 1 M. |
| $1'' \times 1\frac{1}{2}''$ and $1'' \times 2''$ D. & M. hardwood flooring | require 66 hours to place 1 M. |
| $1'' \times 3''$ D. & M. hardwood flooring | require 58 hours to place 1 M. |
| $1'' \times 4''$ D. & M. hardwood flooring | require 53 hours to place 1 M. |
| $1\frac{1}{4}'' \times 2''$ D. & M. hardwood flooring | require 63 hours to place 1 M. |
| $1\frac{1}{4}'' \times 3''$ D. & M. hardwood flooring | require 60 hours to place 1 M. |
| $2'' \times 4''$ and $2'' \times 6''$ rafters | require 33 hours to place 1 M. bd. ft. |
| $2'' \times 8''$ rafters | require 30 hours to place 1 M. bd. ft. |
| $2'' \times 6''$ and $2'' \times 8''$ joists | require 25 hours to place 1 M. bd. ft. |
| $2'' \times 10''$ joists | require 21.5 hours to place 1 M. bd. ft. |
| $2'' \times 12''$ and $2'' \times 14''$ joists | require 20 hours to place 1 M. bd. ft. |
| $3'' \times 8''$ and $3'' \times 10''$ joists | require 20 hours to place 1 M. bd. ft. |
| $3'' \times 12''$, $3'' \times 14''$ and $3'' \times 16''$ joists | require 18 hours to place 1 M. bd. ft. |
| $4'' \times 8''$ and $4'' \times 10''$ joists | require 20 hours to place 1 M. bd. ft. |
| $4'' \times 12''$ and $4'' \times 14''$ joists | require 18.7 hours to place 1 M. bd. ft. |
| $4'' \times 16''$ joists | require 16.7 hours to place 1 M. bd. ft. |
| $6'' \times 6''$ joists | require 20 hours to place 1 M. bd. ft. |
| $6'' \times 8''$ and $6'' \times 10''$ joists | require 18.7 hours to place 1 M. bd. ft. |
| $6'' \times 12''$ and all stuff up to $16'' \times 16''$ for joists | require 16.7 hours to place 1 M. bd. ft. |
| $4'' \times 4''$ posts | require 23 hours to place 1 M. bd. ft. |
| $6'' \times 6''$ posts | require 20 hours to place 1 M. bd. ft. |
| $8'' \times 8''$ posts | require 18 hours to place 1 M. bd. ft. |
| $16'' \times 10''$, $12'' \times 12''$, $14'' \times 14''$ and $16'' \times 16''$ posts | require 16.7 hours to place 1 M. bd. ft. |

TRIM OR FINISH.

It is impossible to give any accurate idea of the amount of time required to do this class of work, there are so many conditions that enter into consideration that can not be stipulated in a table.

Openings require in labor to put in blocks, set jambs or frames, place trim, hang doors or windows and put on hardware from 6 to 12 hours, but average in all sorts of work and buildings about 9 hours.

Baseboard, one member, 1000 lin. ft. requires 50 hours to place.

Baseboard, two member, 1000 lin. ft. requires 66 hours to place.

Baseboard, three member, 1000 lin. ft. requires 83 hours to place.

Plate-shelf, 3 part, consisting of shelf, apron and mould, 1000 lin. ft. requires 100 hours to place; add 1-6 hour for each bracket.

Wainscoting, plain beaded D. & M., requires 23 hours to place 1 M. bd. ft.
Paneled Wainscoting from 2' to 4' 6" high requires about 83 hours to place 1000 lin. ft.
Picture Moulding requires about 33 hours to place 1000 lin. ft.
Ceiling Beams, consisting of blocks, 3 sides and 2 to 4 mouldings, require about 250 hours to place 1000 lin. ft.
Seat with back and sides requires about 8 hours to place.

THE ESTIMATE.

The estimate at best can be little more than an intelligent guess based on past experience. One can never be sure that the same conditions will prevail in the job to be executed as have prevailed in the one just completed. No attempt has been made to suggest a method of estimating cost of interior trim or exterior cornice frames, etc.

Estimated Cost of Rough Work, Floors and Roofs = $\{J \times \text{taken from Table I} \times N\}$, taken from Table IV \times union wages per hour, taken from union scale governing in the locality) + $J \times (\text{price per M of material, obtained}$

from material dealer at the time of making estimate) + (the following for each layer of covering) $\left(\frac{100 \text{ W}}{1000} \times \text{price per M of material}\right) + \left(\frac{100 \text{ W}}{1000} \times N \times H\right)$ times the number of squares of this sort of construction contained in the building.

Estimate for partition work, proceed in same manner as for floor, only substitute from proper table.

Example—Estimate the cost of a 2" x 4" stud partition 11 ft. high and 137 ft. long broken around various rooms and having studs placed 16" from centers and 1" x 1" grounds.

Area = $137 \times 11 = 1507$ sq. ft. = 15.07 squares, $Q = .11027$ from Table II, Col. IV, Dealer's price per M = \$25.00, N 2" x 4" studs from Table IV = .5 hr. $H = \$0.60$. G from formulae (9, 11 = .00756 and N from Table IV = 2 hr.; then $\{(.11027 \times \$25.00) + (.00756 \times \$26.00) + (.11027 \times .5 \times \$0.60)\} + (.00756 \times 2 \times \$0.60)\} = 15.07$

Length in Feet of Joists, Scantling and Timber.

FILE 694.0

| Size in inches | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 42 | 44 | 45 |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 2 x 4 | 8 | 9 | 11 | 12 | 13 | 15 | 16 | 17 | 19 | 20 | 28 | 29 | 30 |
| 2 x 6 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 42 | 44 | 45 |
| 2 x 8 | 16 | 19 | 21 | 24 | 27 | 29 | 32 | 35 | 37 | 40 | 56 | 58 | 60 |
| 2 x 10 | 20 | 23 | 27 | 30 | 33 | 37 | 40 | 43 | 47 | 50 | 70 | 74 | 75 |
| 2 x 12 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 84 | 88 | 90 |
| 3 x 4 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 42 | 44 | 45 |
| 3 x 6 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 45 | 63 | 66 | 68 |
| 3 x 8 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 84 | 88 | 90 |
| 3 x 10 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 105 | 110 | 113 |
| 3 x 12 | 36 | 42 | 48 | 54 | 60 | 66 | 72 | 78 | 84 | 90 | 126 | 132 | 135 |
| 4 x 4 | 16 | 19 | 21 | 24 | 27 | 29 | 32 | 35 | 37 | 40 | 56 | 58 | 60 |
| 4 x 6 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 84 | 88 | 90 |
| 4 x 8 | 32 | 37 | 43 | 48 | 53 | 59 | 64 | 69 | 75 | 80 | 112 | 118 | 120 |
| 4 x 10 | 40 | 47 | 53 | 60 | 67 | 73 | 80 | 87 | 93 | 100 | 140 | 146 | 150 |
| 4 x 12 | 48 | 56 | 64 | 72 | 80 | 88 | 96 | 104 | 112 | 120 | 168 | 176 | 180 |
| 6 x 6 | 36 | 42 | 48 | 54 | 60 | 66 | 72 | 78 | 84 | 90 | 126 | 132 | 135 |
| 6 x 8 | 48 | 56 | 64 | 72 | 80 | 88 | 96 | 104 | 112 | 120 | 168 | 176 | 180 |
| 6 x 10 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 210 | 220 | 225 |
| 6 x 12 | 72 | 84 | 96 | 108 | 120 | 132 | 144 | 156 | 168 | 180 | 250 | 265 | 270 |
| 8 x 8 | 54 | 75 | 85 | 96 | 107 | 117 | 128 | 139 | 149 | 160 | 224 | 234 | 240 |
| 8 x 10 | 50 | 93 | 107 | 120 | 133 | 147 | 160 | 173 | 187 | 200 | 280 | 294 | 300 |
| 8 x 12 | 96 | 112 | 128 | 144 | 160 | 176 | 192 | 208 | 224 | 240 | 336 | 352 | 360 |
| 10 x 10 | 100 | 117 | 133 | 150 | 167 | 183 | 200 | 217 | 233 | 250 | 350 | 366 | 375 |
| 10 x 12 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 | 300 | 420 | 440 | 450 |
| 12 x 12 | 144 | 168 | 192 | 216 | 240 | 264 | 288 | 312 | 336 | 360 | 504 | 528 | 540 |
| 12 x 14 | 168 | 196 | 224 | 252 | 280 | 308 | 336 | 364 | 392 | 420 | 588 | 616 | 630 |
| 14 x 14 | 196 | 220 | 261 | 294 | 327 | 359 | 392 | 425 | 457 | 480 | 686 | 718 | 735 |

NAILS REQUIRED FOR DIFFERENT KINDS OF WORK.

FILE 694.231

For 1,000 shingles, 3 1/2 to 5 lbs. 4d. nails, or 3 to 3 1/2 lbs. 3d.

For 1,000 laths, about 7 lbs. 3d. fine.

For 1,000 feet clapboards, about 18 lbs. 6d. box.

For 1,000 feet covering boards, about 20 lbs. 8d. common, or 25 lbs. 10d.

For 1,000 feet upper floors, square edged, about 38 lbs. 10d. floor, or 41 lbs. 12d. floor.

For 1,000 feet upper floors, matched and blind-nailed, 38 lbs. 10d., or 42 lbs. 12d. common.

For 10 feet partitions, studs or studding, 1 lb. 10d. common.

For 1,000 feet furring, 1x3, about 45 lbs. 10d. common.

For 1,000 feet furring, 1x2, about 65 lbs. 10d. common.

For 1,000 feet pine finish, about 30 lbs. 8d. finish.

OVERLAYING CONSTRUCTION SHEET, SHINGLE AND COMPOSITION COVERING.

FILE 685.1

The average width of a shingle is four inches. Hence, when shingles are laid four inches to the weather each shingle averages 16 square inches, and 900 are required for a square of roofing (100 square feet). If 4½ inches to the weather, 800; 5 inches, 720; 5½ inches, 655; 6 inches, 600.

Slating.

FILE 685.2

Slating is estimated by the "square," which is the quantity required to cover 100 square feet. The slates are usually laid so that the third laps the first three inches.

Number of Slates per Square.

| Size in Inches. | Pieces per Square. | Size in Inches. | Pieces per Square. | Size in Inches. | Pieces per Square. |
|-----------------|--------------------|-----------------|--------------------|-----------------|--------------------|
| 6 × 12 | 533 | 8 × 16 | 277 | 12 × 20 | 141 |
| 7 × 12 | 457 | 9 × 16 | 246 | 14 × 20 | 121 |
| 8 × 12 | 400 | 10 × 16 | 221 | 11 × 20 | 137 |
| 9 × 12 | 355 | 9 × 18 | 213 | 12 × 22 | 126 |
| 7 × 14 | 374 | 10 × 18 | 192 | 14 × 22 | 108 |
| 8 × 14 | 327 | 12 × 18 | 160 | 12 × 24 | 114 |
| 9 × 14 | 291 | 10 × 20 | 169 | 14 × 24 | 98 |
| 10 × 14 | 261 | 11 × 20 | 154 | 16 × 24 | 86 |

The weight of slate per cubic foot is about 174 pounds, or per square foot of various thicknesses as follows:

| | | | | | |
|--------------------------|---------------|----------------|---------------|---------------|---------------|
| Thickness in inches..... | $\frac{1}{8}$ | $\frac{3}{16}$ | $\frac{1}{4}$ | $\frac{3}{8}$ | $\frac{1}{2}$ |
| Weight in pounds..... | 1.81 | 2.71 | 3.62 | 5.43 | 7.35 |

The weight per square foot of roof tiling, set in iron or between wood rafters ready for slating, is about 12 pounds.

Tin Roofs.

FILE 685.4

Tin roofs should be laid with cleats.

There are two kinds of tin—"bright tin," the coating of which is all tin, that is, the tin proper; and "tern," "leaded," or "roofing" tin, the coating of which is a composition, part tin and part lead. This last will not rust any quicker, but the sulphur in soft coal smoke eats through the "leaded" coating sooner than through the "tinned."

Sizes of tin, 10 by 14 and 14 by 20, and two grades of thickness—IC light, and IX, heavy. For a steep roof (one-sixth pitch or over) the IC 14 by 20 tin ("leaded" if high up where little smoke will get to it; "bright" if low down), put on with a standing groove, and with the cross seams put together with a double lock, makes as good a roof as can be made. For flat roofs IX 10 x 14 "light" is best, laid with cleats, but the others make good roofs and any of them will last twenty-five years at least, if painted periodically.

Number of Square Feet a Box of Roofing Tin Will Cover.—For flat seam roofing, using $\frac{1}{2}$ -inch locks, a box of "14 by 20" size will cover about 192 square feet, and for standing seam, using $\frac{3}{8}$ -inch locks and turning $1\frac{1}{4}$ and $1\frac{1}{2}$ inch edges, making 1-inch standing seams, it will lay about 168 square feet.

For flat seam roofing, using $\frac{1}{2}$ -inch locks, a box of "28 by 20" size will cover about 399 square feet, and for standing seam, using $\frac{3}{8}$ -inch locks and turning $1\frac{1}{4}$ and $1\frac{1}{2}$ inch edges, making 1-inch standing seams, it will lay about 365 square feet.

Every box of roofing plates (IC or IX "14 by 20" or "28 by 20" sizes) contains 112 sheets.

For roofs and gutters use seven-pound lead; for hips and ridges, six-pound; for flashings, four-pound.

Gutters should have a fall of at least one inch in ten feet.

No sheet lead should be laid in greater length than ten or twelve feet without a dip to allow for expansion.

Joints to lead pipes require a pound of solder for every inch in diameter.

GRAVEL ROOFING.

Appended are three specifications for good work:

Five (5) Ply Wool Felt, Composition and Gravel Roof

First cover the sheathing boards with one (1) layer of dry felt and over this put four (4) thicknesses of wool roofing felt, weighing not less than fifteen (15) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together the full width of the lap, not less than nine (9) inches between each layer, with best roofing cement, using not less than one hundred (100) pounds of roofing cement to the square of one hundred (100) feet. All joinings along walls and around openings to be carefully made. The roof to be then covered with a heavy coating of roofing cement and screened gravel, not less than one (1) cubic yard of gravel to six hundred (600) square feet, gravel to be screened through $\frac{5}{8}$ -inch mesh and free from sand and loam. All walls and openings to be flashed. If not, the rear end of the walls to be flashed not less than fifteen (15) feet from the gutter on each side.

Six (6) Ply Cap Sheet Wool Felt, Composition and Gravel Roof.

First cover the sheathing boards with one (1) layer of dry felt and over this put four (4) thicknesses of wool roofing felt, weighing not less than fifteen (15) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together the full width of the lap, not less than nine (9) inches between each layer, with best roofing cement, using not less than one hundred and twenty (120) pounds of roofing cement to the square of one hundred (100) feet. The entire surface then to be mopped over with roofing cement and a cap sheet of wool felt applied. All joinings along the walls and around the openings to be carefully made. The roof to be then covered with a heavy coating of roofing cement and screened gravel, not less than one (1) cubic yard of gravel to six hundred (600) square feet, gravel to be screened through $\frac{5}{8}$ -inch mesh and free from sand and loam. All walls and openings to be flashed. If not, the rear end of the walls to be flashed not less than fifteen (15) feet from the gutter on each side.

Six (6) Combined Flax and Wool Felt, Composition and Gravel Roof.

First cover the sheathing boards with one (1) layer of dry felt and over this put one (1) layer of flax felt and three thicknesses of wool roofing felt, weighing not less than fifteen (15) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together the full width of the lap, not less than eleven (11) inches between each layer, with best roofing cement, using not less than one hundred and twenty (120) pounds of roofing cement to the square of one hundred (100) feet. The entire surface then to be mopped over with roofing cement and a cap sheet of wool felt applied. All joinings along walls and around openings to be carefully made. The roof to be then covered with a heavy coating of roofing cement and screened gravel, not less than one (1) cubic yard of gravel to six hundred (600) square feet, gravel to be screened through $\frac{5}{8}$ -inch mesh and free from sand and loam. All walls and openings to be flashed. If not, the rear end of the walls to be flashed not less than fifteen (15) feet from the gutter on each side.

SANITARY EQUIPMENT, ILLUMINATION AND ELECTRIC POWER.

Capacity of Cisterns.

FILE 696

For a circular cistern, square the diameter and multiply by .7854, for the area; multiply this by 1,728 and divide by 231, for number of gallons of one foot in depth; for a square cistern, multiply length by breadth, and proceed as above.

CIRCULAR CISTERN.

| | |
|---------------------------|-------------|
| 5 feet in diameter holds | 4.66 bbls. |
| 6 feet in diameter holds | 6.71 bbls. |
| 7 feet in diameter holds | 9.13 bbls. |
| 8 feet in diameter holds | 11.93 bbls. |
| 9 feet in diameter holds | 15.10 bbls. |
| 10 feet in diameter holds | 18.65 bbls. |

SQUARE CISTERN.

| | |
|--------------------------|-------------|
| 5 feet by 5 feet holds | 5.92 bbls. |
| 6 feet by 6 feet holds | 8.54 bbls. |
| 7 feet by 7 feet holds | 11.63 bbls. |
| 8 feet by 8 feet holds | 15.19 bbls. |
| 9 feet by 9 feet holds | 19.39 bbls. |
| 10 feet by 10 feet holds | 23.74 bbls. |

Wrought-iron Welded Pipe.

DIMENSIONS, WEIGHTS, ETC., OF STANDARD SIZES FOR STEAM, GAS, WATER, OIL, ETC.

| Inside Diameter | Outside Diameter | External Circumference, A | Length of Pipe per Sq. Foot of Outside Surface. | Internal Area | External Area. | Length of Pipe containing one Cubic Foot. | Weight per Foot of Length | No. of Threads per Inch of Screw. | Contents in *Gallons per Foot. | Weight of Water per Foot of Length. |
|-----------------|------------------|---------------------------|---|---------------|----------------|---|---------------------------|-----------------------------------|--------------------------------|-------------------------------------|
| 1 in. | 1 in. | 1 in. | ft. | in. | in. | ft. | lbs. | | | lbs. |
| 1/6 | .40 | 1.272 | 9.44 | .012 | .129 | 2,500 | .24 | 27 | .0006 | .005 |
| 1/4 | .54 | 1.656 | 7.075 | .049 | .229 | 1,385 | .42 | 18 | .0026 | .021 |
| 5/8 | .67 | 2.121 | 5.657 | .110 | .358 | 751.5 | .56 | 14 | .0057 | .047 |
| 1/2 | .84 | 2.652 | 4.502 | .196 | .554 | 472.4 | .84 | 14 | .0102 | .085 |
| 3/4 | 1.05 | 3.299 | 3.637 | .441 | .866 | 270. | 1.12 | 11 1/2 | .0230 | .190 |
| 1 | 1.31 | 4.134 | 2.903 | .785 | 1.357 | 166.9 | 1.67 | 11 1/2 | .0405 | .349 |
| 1 1/4 | 1.66 | 5.215 | 2.301 | 1.227 | 2.104 | 96.25 | 2.25 | 11 1/2 | .0635 | .527 |
| 1 1/2 | 1.9 | 5.999 | 2.01 | 1.767 | 2.535 | 70.65 | 2.69 | 11 1/2 | .0918 | .760 |
| 2 | 2.37 | 7.461 | 1.611 | 3.141 | 4.330 | 42.36 | 3.66 | 8 | .1032 | 1.356 |
| 2 1/2 | 2.87 | 9.032 | 1.328 | 4.908 | 6.491 | 30.11 | 5.77 | 8 | .2550 | 2.116 |
| 3 | 3.5 | 10.996 | 1.001 | 7.068 | 9.621 | 19.49 | 7.54 | 8 | .3673 | 3.049 |
| 3 1/2 | 4 | 12.566 | .955 | 9.621 | 12.566 | 14.56 | 9.05 | 8 | .4993 | 4.155 |
| 4 | 4.5 | 14.137 | .849 | 12.566 | 15.904 | 11.31 | 10.72 | 8 | .6525 | 5.405 |
| 4 1/2 | 5 | 15.708 | .765 | 15.904 | 19.635 | 9.03 | 12.49 | 8 | .8263 | 6.851 |
| 5 | 5.56 | 17.475 | .629 | 19.635 | 24.299 | 7.20 | 14.56 | 8 | 1.020 | 8.500 |
| 6 | 6.62 | 20.813 | .577 | 28.274 | 34.471 | 4.98 | 18.76 | .8 | 1.469 | 12.312 |
| 7 | 7.62 | 23.954 | .505 | 38.484 | 45.663 | 3.72 | 23.41 | 8 | 1.999 | 16.662 |
| 8 | 8.62 | 27.096 | .444 | 50.265 | 58.426 | 2.88 | 28.34 | 8 | 2.611 | 21.750 |
| 9 | 9.68 | 30.433 | .394 | 63.617 | 73.715 | 2.26 | 34.67 | 8 | 3.300 | 27.500 |
| 10 | 10.75 | 33.772 | .355 | 78.540 | 90.792 | 1.80 | 40.64 | 8 | 4.081 | 34.000 |

* The Standard U. S. gallon of 231 inches.

Divide the external circumference column, A, by 12 and the result will be the square feet of surface per lineal foot.

Quantity of Brickwork in Barrel Drains and Wells.

| Diameter in Clear | Thickness of Brickwork | Superficial Feet of Brick-work in One Linear Yard. | Number of Bricks Required for One Linear Yard |
|-------------------|------------------------|--|---|
| 1 foot, 0 inches | 0 feet, 4 1/2 inches | 16 feet, 6 inches | 115 |
| 1 " 6 " | 0 " 4 1/2 " | 21 " 2 " | 148 |
| 2 " 0 " | 0 " 4 1/2 " | 25 " 10 " | 181 |
| 2 " 6 " | 0 " 9 " | 33 " 0 " | 462 |
| 2 " 6 " | 0 " 9 " | 37 " 8 " | 528 |
| 2 " 6 " | 1 " 1 " | 43 " 2 " | 906 |
| 3 " 0 " | 0 " 9 " | 42 " 6 " | 594 |
| 3 " 0 " | 1 " 1 " | 47 " 10 " | 1004 |
| 3 " 6 " | 0 " 9 " | 47 " 1 " | 659 |
| 3 " 6 " | 1 " 1 " | 52 " 7 " | 1104 |
| 4 " 0 " | 0 " 9 " | 51 " 10 " | 725 |
| 4 " 0 " | 1 " 1 " | 57 " 3 " | 1203 |
| 5 " 0 " | 0 " 9 " | 61 " 3 " | 857 |
| 5 " 0 " | 1 " 1 " | 66 " 9 " | 1402 |
| 6 " 0 " | 1 " 1 " | 76 " 1 " | 1597 |
| 7 " 0 " | 1 " 1 " | 85 " 6 " | 1795 |

Tests for Pure Water.

Color: Fill a clean long bottle of colorless glass with the water; look through it at some black object. It should look colorless and free from suspended matter. A muddy or turbid appearance indicates soluble organic matter or solid matter in suspension. **Odor:** Fill the bottle half full, cork it, and leave it in a warm place for a few hours. If when uncorked it has a smell the least repulsive, it should be rejected for domestic use. **Taste:** If water at any time, even after heating, has a disagreeable taste, it should be rejected.

A simple semi-chemical test is known as the "Heisch test." Fill a clean pint bottle three-fourths full of the water; add a half-teaspoonful of clean granulated or crushed loaf sugar; stop the bottle with glass or a clean cork and let it stand in a light and moderately warm room for forty-eight hours. If the water becomes cloudy, or milky, it is unfit for domestic use.

Grade Per Mile.

The following table will show the grade per mile:

An inclination of

| | |
|------------------------------------|------------------------------------|
| 1 foot in 15 is 352 feet per mile. | 1 foot in 40 is 132 feet per mile. |
| 1 foot in 20 is 264 feet per mile. | 1 foot in 50 is 106 feet per mile. |
| 1 foot in 25 is 211 feet per mile. | 1 foot in 100 is 53 feet per mile. |
| 1 foot in 30 is 176 feet per mile. | 1 foot in 125 is 42 feet per mile. |
| 1 foot in 35 is 151 feet per mile. | |

To find quantity of water elevated in one minute running at 100 feet of piston speed per minute: Square the diameter of the water cylinder in inches and multiply by 4. Example: Capacity of a 5-inch cylinder is desired. The square of the diameter (5 inches) is 25, which, multiplied by 4, gives 100, the number of gallons per minute (approximately).

To find the depth of a joist, the length of bearing and the thickness being given:

Rule.—Divide the square of the length in feet by the thickness in inches, and the cube root of the quotient, multiplied by 2.2 for pine, or 2.3 for oak, will be the depth in inches.

Capacity of Drain Pipe.

| SIZE OF PIPE. | GALLONS PER MINUTE. | | | | | | | |
|---------------|---------------------------------------|------------------------|------------------------|------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | 1 $\frac{1}{2}$ -in. Fall per 100 ft. | 3-in. Fall per 100 ft. | 6-in. Fall per 100 ft. | 9-in. Fall per 100 ft. | 12-in. Fall per 100 ft. | 18-in. Fall per 100 ft. | 24-in. Fall per 100 ft. | 36-in. Fall per 100 ft. |
| 3-inch | 21 | 30 | 42 | 52 | 60 | 74 | 85 | 104 |
| 4 " | 36 | 52 | 76 | 92 | 108 | 132 | 148 | 184 |
| 6 " | 84 | 120 | 169 | 206 | 240 | 294 | 338 | 414 |
| 9 " | 232 | 330 | 470 | 570 | 660 | 810 | 930 | 1140 |
| 12 " | 470 | 680 | 960 | 1160 | 1360 | 1670 | 1920 | 2350 |
| 15 " | 830 | 1180 | 1680 | 2040 | 2370 | 2920 | 3340 | 4100 |
| 18 " | 1300 | 1850 | 2630 | 3200 | 3740 | 4600 | 5270 | 6470 |
| 20 " | 1760 | 2450 | 3450 | 4180 | 4860 | 5980 | 6850 | 8410 |

Table showing the velocity of discharge of different sized sewers.

| Diam. of pipe. | 180 feet per minute, 3 feet per second. | | 270 feet per minute, 4 $\frac{1}{2}$ feet per second. | | 360 feet per minute, 6 feet per second. | | 540 feet per minute, 9 feet per second. | |
|----------------|--|---------------------|--|---------------------|--|---------------------|--|---------------------|
| | Fall. | Gallons per minute. | Fall. | Gallons per minute. | Fall. | Gallons per minute. | Fall. | Gallons per minute. |
| 3..... | 1 in 69 | 54 | 1 in 30.4 | 81 | 1 in 17.2 | 108 | 1 in 7.6 | 162 |
| 4..... | 1 in 92 | 96 | 1 in 40.8 | 144 | 1 in 23 | 192 | 1 in 10.2 | 288 |
| 6..... | 1 in 138 | 216 | 1 in 61.2 | 324 | 1 in 34.5 | 432 | 1 in 15.3 | 648 |
| 9..... | 1 in 207 | 495 | 1 in 92. | 742.5 | 1 in 51.7 | 990 | 1 in 23 | 1,485 |

HEATING VENTILATION AND STEAM POWER.

Hot-Water and Steam Heating—Overhead System.

FILE 697.41

In using steam for the heating of high buildings, it is necessary to use the overhead plan, unless some automatic system of expelling the air is adopted. It requires less power to force the air through the standpipe than it would through a large number of risers. The air is forced out on the descent of the steam, and less fuel and power are necessary.

The overhead hot-water system is coming into general use, as it can be put in so that the farthest radiators in a building will heat at the same time as those nearer the boiler, and the result will also be felt in rooms in the basement—the principle of the siphon causing the effect.

The pipes from the main in the attic, from which the several branches are taken, can be pitched so that heat in the several parts of a building will result as quickly as desired; either an open or closed tank can be used. The pipes exposed in attic should be covered. Opinions vary as to the sizes of pipe to be used.

List of Sizes of Steam Mains.

FILE 697.42

To determine the size of pipes no fixed rule can be given which will apply in all cases. A rule that has generally been accepted by steam fitters as good practice, is to allow the area of a one-inch pipe (.7854 square inches) for every 100 square feet of radiating surface, including mains.

BOILER EFFICIENCY TABLE Based on evaporation from and at 212° F.

| B. T. U. Per Lb. Coal. | 50% Efficiency | | 55% Efficiency | | 60% Efficiency | | 65% Efficiency | | 70% Efficiency | | 75% Efficiency | | 80% Efficiency | | | | | |
|------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|------|-----|------|-----|
| | Evaporation Per Lb. Coal. | Lbs. Coal Per H. P. Hour. | | | | |
| 7500 | 3.8 | 9.0 | 4.2 | 8.2 | 4.6 | 7.5 | 5.0 | 6.8 | 5.4 | 6.4 | 5.8 | 6.0 | 6.2 | 5.5 | 6.6 | 5.2 | 5.5 | 5.2 |
| 8000 | 4.1 | 8.4 | 4.5 | 7.6 | 4.9 | 7.0 | 5.3 | 6.5 | 5.7 | 6.0 | 6.1 | 5.6 | 6.6 | 5.2 | 7.0 | 4.9 | 6.6 | 5.2 |
| 8500 | 4.4 | 7.8 | 4.8 | 7.1 | 5.2 | 6.6 | 5.7 | 6.0 | 6.1 | 5.6 | 6.6 | 5.3 | 6.9 | 5.0 | 7.4 | 4.6 | 7.4 | 4.6 |
| 9000 | 4.6 | 7.5 | 5.1 | 6.7 | 5.5 | 6.2 | 6.1 | 5.5 | 6.5 | 5.3 | 6.9 | 5.0 | 7.4 | 4.6 | 8.2 | 4.2 | 8.2 | 4.2 |
| 9500 | 4.9 | 7.0 | 5.4 | 6.3 | 5.9 | 5.8 | 6.3 | 5.4 | 6.8 | 5.0 | 7.3 | 4.7 | 7.7 | 4.4 | 7.8 | 4.4 | 7.8 | 4.4 |
| 10000 | 5.1 | 6.7 | 5.6 | 6.1 | 6.2 | 5.5 | 6.7 | 5.1 | 7.2 | 4.7 | 7.7 | 4.4 | 8.2 | 4.2 | 8.6 | 4.0 | 9.1 | 3.7 |
| 10500 | 5.4 | 6.3 | 5.9 | 5.8 | 6.5 | 5.3 | 7.1 | 4.8 | 7.6 | 4.5 | 8.1 | 4.2 | 8.6 | 4.0 | 9.5 | 3.6 | 9.5 | 3.6 |
| 11000 | 5.6 | 6.1 | 6.2 | 5.5 | 6.8 | 5.0 | 7.4 | 4.6 | 7.9 | 4.3 | 8.5 | 4.0 | 9.1 | 3.7 | 9.9 | 3.4 | 10.3 | 3.3 |
| 11500 | 5.9 | 5.8 | 6.5 | 5.3 | 7.1 | 4.8 | 7.7 | 4.4 | 8.3 | 4.1 | 8.9 | 3.8 | 9.5 | 3.4 | 10.7 | 3.2 | 11.1 | 3.1 |
| 12000 | 6.2 | 5.5 | 6.8 | 5.0 | 7.4 | 4.6 | 8.0 | 4.3 | 8.6 | 4.0 | 9.3 | 3.7 | 9.9 | 3.4 | 11.5 | 3.0 | 12.0 | 2.8 |
| 12500 | 6.4 | 5.3 | 7.1 | 4.8 | 7.7 | 4.4 | 8.4 | 4.1 | 9.0 | 3.8 | 9.7 | 3.5 | 10.3 | 3.2 | 11.5 | 3.0 | 12.0 | 2.8 |
| 13000 | 6.7 | 5.1 | 7.4 | 4.6 | 8.0 | 4.3 | 8.7 | 3.9 | 9.4 | 3.6 | 10.0 | 3.4 | 10.7 | 3.2 | 11.1 | 3.1 | 12.0 | 2.8 |
| 13500 | 6.9 | 5.0 | 7.6 | 4.5 | 8.3 | 4.1 | 9.0 | 3.8 | 9.7 | 3.5 | 10.4 | 3.3 | 11.1 | 3.1 | 12.0 | 3.0 | 12.0 | 2.8 |
| 14000 | 7.2 | 4.7 | 7.9 | 4.3 | 8.6 | 4.0 | 9.4 | 3.6 | 10.1 | 3.4 | 10.8 | 3.2 | 11.5 | 3.0 | 12.0 | 2.8 | 12.0 | 2.8 |
| 14500 | 7.5 | 4.6 | 8.2 | 4.2 | 9.0 | 3.8 | 9.7 | 3.5 | 10.5 | 3.2 | 11.2 | 3.0 | 12.0 | 2.8 | 12.0 | 2.8 | 12.0 | 2.8 |

SPACE OCCUPIED BY FUEL.

Coals of the same size coming from different mines vary in density, but the space given below is an average for best fuels:

| | | |
|------------------|------|---------------------------|
| Stove Anthracite | 33 | cubic feet per 2,000 lbs. |
| Egg Anthracite | 32.5 | cubic feet per 2,000 lbs. |
| Soft Coal | 40 | cubic feet per 2,000 lbs. |
| Coke | 68 | cubic feet per 2,000 lbs. |

| | |
|-------------------------|--------------|
| Window glass being..... | 1,000 |
| Oak or Walnut | 66 |
| White Pine..... | 80 |
| Pitch “ | 100 |
| Lath and Plaster..... | 75 to 100 |
| Brick (rough)..... | 200 to 250 |
| “ Whitewashed..... | 200 |
| Granite or Slate..... | 250 |
| Sheet Iron..... | 1030 to 1110 |

Table Showing Amount of Glass Surface which may be Heated by 1 Square Foot of Radiating Surface in Good Buildings.

| Temperature of radiating surface (radiators) Fahr | Hot Water. | | | Steam. | |
|--|------------|------|------|----------------|-----------------|
| | 160° | 180° | 200° | 227° 5 Lbs. | 240° 10 Lbs. |
| Square Feet of Glass to 1 Square Foot Radiator Surface. | | | | | |
| Temperature above surrounding air 90° | 1.9 | 2.3 | 2.8 | 3.3 | 3.8 |
| “ “ “ 80° | 2.3 | 2.9 | 3.5 | 4.0 | 4.6 |
| “ “ “ 70° | 3.0 | 3.6 | 4.2 | 5.0 | 5.7 |
| “ “ “ 60° | 4.0 | 4.6 | 5.25 | 6.0 | 7.0 |
| “ “ “ 50° | 5.0 | 6.0 | 6.8 | 8.0 | 9.0 |
| “ “ “ 40° | 6.9 | 8.0 | 8.2 | 10.0 | 11.5 |

Proportion of Parts of Steam Heating Boilers.

FROM PROF. R. C. CARPENTER.

| Radiating surface=square feet..... | 250 | 500 | 750 | 1000 | 1500 | 2000 | 3000 | 4000 | 5000 | 7500 | 10000 |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|
| Nominal horse-power..... | 2.5 | 5.0 | 7.5 | 10.0 | 15.0 | 20.0 | 30.0 | 40.0 | 50.0 | 75.0 | 100.0 |
| Ratio radiating to heating surface..... | 4.5 | 5.1 | 5.4 | 5.6 | 6.0 | 6.2 | 6.7 | 6.9 | 7.0 | 7.0 | 7.0 |
| Probable evaporation per lb. coal..... | 5.5 | 5.7 | 6.0 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 | 9.5 | 10.0 |
| Pounds of steam per sq. ft. grate (A)..... | 55.0 | 57.0 | 60.0 | 65.0 | 70.0 | 75.0 | 80.0 | 85.0 | 90.0 | 95.0 | 100.0 |
| Pounds of steam per sq. ft. grate (B)..... | 44.0 | 46.0 | 48.0 | 52.0 | 56.0 | 60.0 | 64.0 | 68.0 | 72.0 | 76.0 | 80.0 |
| Ratio radiating to grate surface (A)..... | 165.0 | 171.0 | 180.0 | 195.0 | 210.0 | 225.0 | 240.0 | 255.0 | 270.0 | 285.0 | 300.0 |
| Ratio radiating to grate surface (B)..... | 132.0 | 138.0 | 144.0 | 156.0 | 168.0 | 180.0 | 192.0 | 204.0 | 216.0 | 228.0 | 240.0 |
| Ratio heating to grate surface (A)..... | 36.5 | 33.2 | 33.2 | 34.8 | 35.0 | 36.2 | 36.5 | 37.0 | 38.5 | 40.5 | 42.5 |
| Ratio heating to grate surface (B)..... | 28.5 | 27.0 | 26.7 | 27.7 | 28.0 | 29.0 | 29.3 | 29.6 | 30.8 | 32.2 | 34.5 |
| Heating surface, square feet..... | 55.0 | 98.0 | 138.0 | 178.0 | 250.0 | 322.0 | 447.0 | 580.0 | 710.0 | 1071 | 1430 |
| Grate surface, square feet (A)..... | 1.52 | 2.92 | 4.15 | 5.68 | 7.15 | 8.9 | 12.4 | 15.7 | 18.5 | 26.5 | 33.3 |
| Grate surface, square feet (B)..... | 1.88 | 3.88 | 5.4 | 6.37 | 8.92 | 11.2 | 15.5 | 19.5 | 23.2 | 32.5 | 41.5 |
| Diameter of safety valve, inches..... | 1.5 | 2.25 | 2.50 | 2.75 | 3.0 | 3.25 | 3.5 | 4.2 | 4.0 | 2 of 3 | 2 of 4 |
| Diameter of smoke flues, inches..... | 7.0 | 10.0 | 11.2 | 12.0 | 15.0 | 17.0 | 19.0 | 23.0 | 25.0 | 28 | 3A |
| Square inches in above flues..... | 38.5 | 78.5 | 95.0 | 113.0 | 176.7 | 227.0 | 283.5 | 415.5 | 490.9 | 615.7 | 907.9 |

* Water tube boilers.

A When rate of coal consumption is 10 pounds per hour each square foot grate surface.

B When rate of coal consumption is 8 pounds per hour each square foot grate surface.

Rules for Calculating Speed of Pulleys.

I.—The diameter of the driver and driven being given, to find the number of revolutions of the driven:

Rule.—Multiply the diameter of the driver by its number of revolutions, and divide the product by the diameter of the driven; the quotient will be the number of revolutions.

II.—The diameter and the revolutions of the driver being given, to find the diameter of the driven, that shall make any given number of revolutions in the same time:

Rule.—Multiply the diameter of the driver by its number of revolutions, and divide the product by the number of revolutions of the driven; the quotient will be its diameter.

III.—To ascertain the size of the driver:

Rule.—Multiply the diameter of the driven by the number of revolutions you wish to make, and divide the product by the revolutions of the driver; the quotient will be the size of the driver.

Belts.

Leather belts must be well protected against water, and even moisture.

India-rubber is the proper substance for belts exposed to the weather.

It is desirable to run the grain (hair) side of leather belts on the pulley, in order that the strongest part of the belt may be subject to the least wear.

Leather belts run with grain side to the pulley will drive thirty per cent more than if run with flesh side. The belt, as well as the pulley, adheres best when smooth, and the grain side adheres best because it is smoothest.

The transmitting power of a double belt is to that of single belt as 10 is to 7. In ordering pulleys, the kind of belt to be used should always be specified.

Belts should be kept soft and pliable. For this purpose blood-warm tallow, dried in by heat of fire or the sun, is advised. Castor-oil dressing is also good.

The motion of driving should run *with* and not *against* the laps of the belts.

If too great a distance is attempted, the weight of the belt will produce a very heavy sag, drawing so hard on the shaft as to produce great friction in the bearings, while at the same time the belt will have an unsteady, flapping motion, which will destroy both the belt and machinery.

If possible to avoid it, connected shafts should never be placed one directly over the other, as in such case the belt must be kept very tight to do the work. For this purpose belts should be carefully selected of *well-stretched* leather.

It is desirable that the angle of the belt with the floor should not exceed 45 degrees. It is also desirable to locate the shafting and machinery so that belts should run off from each shaft in opposite directions, as this arrangement will relieve the bearings from the friction that would result when the belts all pull one way on the shaft.

The diameter of the pulleys should be as large as can be admitted.

The pulley should be a little wider than the belt required for the work.

When it is not convenient to measure with the tape line the length required, apply the following rule: Add the diameter of the two pulleys together, divide the result by 2, and multiply the quotient by $3\frac{1}{4}$, then add this product to twice the distance between the centers of the shafts, and you have the length required.

The width of belt needed depends on three conditions: 1. The tension of the belt. 2. The size of the smaller pulley, and the proportion of the surface touched by the belt. 3. The speed of the belt.

The working adhesion of a belt to the pulley will be in proportion both to the number of square inches of belt contact with the surface of the pulley and also to the arc of the circumference of the pulley touched by the belt. This adhesion forms the basis of all right calculation in ascertaining the width of belt necessary to transmit a given horse-power.

PROTECTIVE, PRESERVATIVE AND DECORATIVE COVERINGS. ESTIMATES ON PAINTING.

By EMERY STANFORD HALL, B. S.

PAINTER'S ESTIMATE = (units of surface to be covered) \times (amount of material required to cover a unit) \times (cost of a unit of material) + [(number of hours of labor required by a mechanic to apply the material to a single unit of surface) \times (hourly wage of mechanic) \times (number of units of surface)] + (overhead charges, including scaffolding, brushes, drop-cloths, cartage, office expense and expense of supervision, etc.) + (Contractor's profit, which varies with the supply and demand).

UNITS OF SURFACE USED ARE (one sq. ft.), (sq. yd.=9 sq. ft.) or (square=100 sq. ft.).

AMOUNT OF SURFACE UNITS assumed for estimating purposes are increased at the judgment of the estimator. This is done to make proper allowance for increased labor and waste of material on account of broken and complicated surfaces, and so that prices per unit of labor and material can be maintained constant, the following enumerations being the assumptions most commonly used by estimators:

PLAIN D. & M. Wainscoting or partition stuff is measured once, actual surface, and is used as the standard of comparison. Other surfaces are increased in proportion as their difficulty of execution compares with D. & M. Wainscoting.

Sash for exterior are measured over the entire area instead of around each bar.

Shingle Gable, $1\frac{1}{2}$ \times actual surface area.

Dormer Windows 2 \times actual surface area.

Shingles, Rough, $1\frac{1}{2}$ to 2 \times actual surface area.

Shingles, Dressed, Dimension, actual surface measure.

Spindle work, measure 4 times solid on one side.

Square Spindle work and pickets, 4 \times one side measured solid.

Verandas with heavy columns and railings, etc., measure surface of ceiling and floors and all sides the same as though enclosed veranda. Very simple in design, measure floor and ceiling and allow double area of brackets and columns.

Outside Blinds, measure 3 \times actual surface of one side.

INTERIOR.

Base Boards, measure not less than 1 foot in width regardless of actual width.

Picture Mouldings, measure 1-3 foot in width.

Single Doors, including trim, count as 35 sq. ft. to a side or 70 sq. ft. for both sides.

Interior Side of Windows, including trim and tracing of sash, average at 35 sq. ft.

Wall Decorations, measure ceiling solid and sidewalls 8-10 of actual area to allow for openings, or measure actual area and deduct $\frac{1}{2}$ to $\frac{2}{3}$ of all openings.

Badly Weathered wood work or cracked and damaged plaster, add from 1-10 to 3-10 to measurements determined as above.

MATERIALS, COVERING POWER OF.

White Lead Paste averages to contain by bulk 92% dry lead pigment and 8% linseed oil and weighs about 38.4206 lbs. to the gallon of bulk.

Carbonate of Lead = chemically to $PbCO_3$, was the lead formerly used in paints as a pigment. The fumes of this preparation of lead are poisonous and workmen have to

be very careful in handling this material to avoid soiling hands or inhaling fumes from the same.

Sublimed Lead or Basic Lead Sulphate = chemically to $PbSO_4$, is coming into general use for paints and is practically non-poisonous and just as valuable as a pigment.

Linseed Oil weighs about $7\frac{1}{2}$ lbs. to the gal. of bulk.

Turpentine weighs about 7 lbs. to the gal. of bulk.

Primer of Lead and Oil for new work should be proportioned by bulk, so as to contain 27% of White Lead Paste, 62% of Linseed Oil and 11% of Turpentine.

Priming Lead and Oil will require 10.3 lbs. White Lead, .62 gal. Linseed Oil and .11 gal. Turpentine to make one gal. of paint.

One Gallon Lead and Oil Primer will average to properly cover about $2\frac{3}{4}$ squares of new wood work or $1\frac{1}{4}$ squares of common brick work.

One Square of New Wood Work requires to properly prime same with lead and oil $3\frac{3}{4}$ lbs. White Lead, .23 gal. Linseed Oil and .04 gal. Turpentine, or if common brick requires 8.24 lbs. White Lead, .5 gal. Linseed Oil and .088 gal. Turpentine.

Succeeding Coats of Lead and Oil Paint after primer should be proportioned by bulk so as to contain 30% White Lead, 64% Linseed Oil and 6% of Turpentine.

Succeeding Coats of Lead and Oil Paint after priming will require 11.44 lbs. White Lead Paste, .64 gal. Linseed Oil and .06 gal. of Turpentine to the gal.

One Gallon Lead and Oil Succeeding Coater will average to properly cover, any coat, about $4\frac{1}{2}$ squares of wood work after same has been primed, or 3 squares of common brick work, second coat. Third coat on brick work, one gal. will cover as much surface as on wood.

One Square of Any Oil Succeeding Coat on wood work after same has been primed will average to require to properly cover same 2.54 lbs. White Lead, .14 gal Linseed Oil and .0133 gal. of Turpentine; or for 2nd coat on common brick work, 3.48 lbs. White Lead, .21 gal. Linseed Oil and .02 gal. of Turpentine. Third coat on brick work will require the same amount of paint to unit of surface as "Succeeding Coats" on wood.)

Paste Filler for open grained hard-wood finish or floors requires for proper filling and wiping $1\frac{1}{2}$ lbs. Silex paste and .14 gal. thinner to the square.

Wiping of paste filler is done with burlap, sea moss or excelsior and should always be done across the grain of the wood as if rubbed with the grain of the wood there is a tendency to lift the filler out of the pores of the wood and waste same, requiring more filler to give satisfactory results.

Thinner for paste filler may be either Turpentine or Benzine if the filler is of best quality of rock quartz, water floated, very finely bolted and mixed with special Japan's and Linseed Oil. Benzine seems to give the most satisfactory results for a thinner owing to its quicker evaporation. For the cheaper fillers Turpentine must be used.

Paste Filler is tinted or left transparent according to the color effect desired.

Stains for wood work usually form one coat in addition to filler and coats of varnish or wax; these are of three kinds, oil-stain, spirit-stain and water-stain, and are used according to the effect desired.

Oil-Stain averages to require about .16 gal. to the square.

Spirit-Stain averages to require about .16 gal. to the square.

Water-Stain averages to require about .2 gal. to the square.

Prepared Wax averages to require about .33 lbs. to the square.

Varnish, Best Light Interior, requires for properly coating one square, 1st coat over filler, 1-5 to 1-7 gal.

Varnish, Cheap, Thick Rosin, requires for coating one square one gloss coat, $\frac{1}{4}$ to 1-5 gal.

Creosote Stain required to dip $\frac{1}{2}$ length one M. shingles equals about 2 $\frac{3}{4}$ gal.

Creosote Stain required to brush coat one square shingles equals one gal.

Oil Paint to cover one square metal work, one coat requires about 1-10 gal.

Prices of standard materials are quoted in market reports and fluctuate with supply and demand. The estimator should verify these preceding each estimate. At time of going to press the following prices obtain:

White Lead Paste, 6 $\frac{3}{4}$ c per lb.

Linseed Oil, 54c per gal.

Turpentine, 56c per gal.

Paste Filler, about 10c per lb. in 100-lb. packages or 8 $\frac{1}{2}$ c in bbls.

Interior Varnishes, about \$2.00 per gal.

Stains vary so much in price that they can not be listed.

First Class Exterior Varnishes, about \$3.50 per gal. (It should be explained that owing to the slow drying or hardening qualities of best exterior varnishes, a cheaper and less durable grade is usually used, costing about \$2.50 per gal.)

Proprietary Oil Paints of best quality are sold to the painters at about \$1.50 per gal., depending on color. The materials in a gal. of White Lead and Linseed Oil "Succeeding Coat" of paint costs exclusive of labor and coloring matter about \$1.14 at present market prices and the labor of mixing by hand and the expense for colors brings this hand-mixed paint up in price to about the same as proprietary paints of equal quality. Unless the ingredients composing paint are thoroughly evaporated the paint is not satisfactory. This proper mixing, if done by hand, requires considerable expensive labor.

Chemical action between the pigments and oil in paint ordinarily does not occur, but there are exceptions. Sabin states that such action takes place with White Lead and Linseed Oil, "probably between the oil and the lead hydrate, which constitutes at least a quarter of the pigment." "This change is said to be due to resinsification of the oil converting into a sort of varnish." "Zinc Oxide (White Zinc) also acts on oil, but in a much less degree." "Paint consisting of White Lead and White Zinc mixed together in the proportions of two of lead to one of zinc is reputed to be superior to either alone. Zinc brushes more readily, but will cover less surface than White Lead."

Linseed Oil is the only known universally successful binder for paint and the holding power of the paint depends almost entirely on the strength of the linseed oil used. This oil is adulterated in many ways, but the most common is with mineral oil. The manufacturers of mineral oil substitute have perfected their product to such an extent that it is difficult to distinguish it from the real article except by chemical test or actual use, when its inferiority is quickly manifest.

LABOR REQUIRED.

COST OF LABOR = (number of hours of labor required by a mechanic to prepare the material to the single unit of surface) \times (hourly wage of mechanics) \times (number of units of surface).

Wage per Hour = union scale obtaining in the locality where the work is to be exe-

cut. (In Chicago, this is 55c per hour under an agreement expiring April 1st, 1909.)

Stopping knots with shellac requires in labor .2 of an hour's time to the square of surface.

Putting defects in ordinary wood work requires in labor .3 of an hour's time to the square of surface.

Oil painting, single coat, requires in labor .57 of an hour's time to the square of surface.

Paste Filler Coat, including cleaning of wood work, requires in labor 1.33 hours' time to the square of surface.

Varnish, single coat, including light sandpapering, requires in labor .66 of an hour's time to the square of surface.

Creosote staining of shingles by $\frac{1}{2}$ dipping, requires in labor 1 hour of a mechanic's time to dip 1,000 shingles, which average to cover when laid, one square of roof surface.

Creosote staining, one brush coat on roof, requires in labor .8 hour's time to cover one square of surface.

Sizing of plaster walls with either glue or hard oil size requires in labor .33 of an hour's time to the square of surface.

Tinting with water color, fresco tints or calcimine averages to require in labor .44 hour's time to the square of surface to the man employed, providing not less than two men are employed on the work. (Ordinarily, one man cannot work alone at tinting of walls, for if he does so work, the work cannot be satisfactorily done and more time is required in proportion to the surface covered.)

Sponging and washing walls requires in labor a variable amount of time to the square according to the amount of size used in coat to be removed and must be approximated by the estimator after examination and test.

ILLUSTRATIVE CHARGES FOR CONTRACT WORK.

The following items illustrate some of the average charges made by contractors for material and labor at the time of going to press:

Whitewashing (machine applied) including material, labor and contractor's profit, about 25c per square, varying according to the size of the job, sometimes, in case of very large jobs, being figured as low as 8 $\frac{1}{2}$ c.

Whitewashing (hand brush applied), including material and labor and contractor's profit, about 50c per square.

Painting, two coat work, is estimated as worth \$2.25 per square; itemized, 50c for all material and \$1.75 for labor and profit.

Varnish work, including one coat of paste filler and two coats of varnish, is worth about \$2.50 per square.

Sizing walls is worth about 75c per square for hard oil size.

Tinting walls, depending on color, averages to be worth 80c per square.

FIXED CHARGES.

The expenses of conducting the painting contracting business vary according to the efficiency of organization and range from 25 to 35 per cent of the cost of executing the work.

THE ESTIMATE.

After surfaces are measured and materials and labor are priced, as described above, and items totalled, about 30 per cent should be added to cover fixed charges and a percentage for profit, varying according to the reputation of the contractor, which will give the probable contract price of the work.



1.



2.



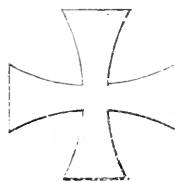
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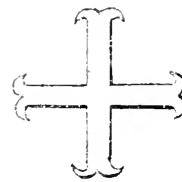
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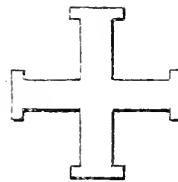


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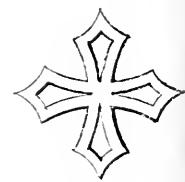


7.

CROSSES.



8.



9.

The cross, a symbol of Christianity, has very naturally been extensively used in the monuments of the middle ages. When the two branches of the cross are equal in length, as in Fig. 1, the cross is called a Greek cross, and when the stem is longer than the arms, as in Fig. 2, it is a Roman or Latin cross. When the figure has two arms, one longer than the other, as in Fig. 3 (the upper one meant as a representation of the inscription which was placed over the head of Christ) it is known by the name of the Lorraine cross, and has received that name from its being a bearing in the arms of the Dukes of Lorraine. By heralds this is called a patriarchal cross. The next cross, whose arms are triple, as Fig. 4, is the papal cross, and is one of the emblems of the papacy, signifying, perhaps, like the triple crown or tiara, the triple sovereignty over the universal church, the suffering church and the triumphant church. The great majority of the western churches, with transepts, are constructed in the form of the Latin cross, those in the form of the Greek cross being very rare. Those in the form of the Lorraine cross are still rarer, and rarer are those constructed with triple transepts. There is another form called the truncated or tau cross, as Fig. 5, having the form of that letter, on which, as a plan, a few churches have been built. Considered as respects the contour, the cross in blason has been variously shaped and named. Thus, Fig. 6, in which the extremities widen as they recede from the center, is called a cross patee. This is met with more frequently than any of the others. It is seen in the nimbus, on tombs, on shields, upon coins, etc.; and is the usual form of the dedication cross found in religious structures. Fig. 7 is by the French called ancree, the extremities forming hooks, but by heralds it is called the cross moline. Crosses flory are those in which the ends are formed into trefoils, as is seen in Fig. 4, the papal cross above mentioned. Fig. 8 is a cross potent, and Fig. 9 is the cross clehee, as respects the outer lines of its form; when it is voided, as shown by the inner lines, the ground or field is seen on which it lies.

SYMBOLS FOR THE APOSTLES.

From the constant occurrence of symbols in many cathedrals of the present day, the following list may be found useful:

PETER—Bears a key, or two keys with different wards. ANDREW—Leans on a cross so called from him; called by heralds the saltire. JOHN THE EVANGELIST—With a chalice, in which is a winged serpent. When this symbol is used, the eagle, another symbol of him, is never given. BARTHOLOMEW—With a flaying-knife. JAMES THE LESS—A fuller's staff bearing a small square banner. JAMES THE GREATER—A pilgrim's staff, hat, and escallop-shell. THOMAS—An arrow, or with a long staff. SIMON—A long saw. JUDE—A club. MATTHIAS—A hatchet. PHILIP—Leans on a spear or has a long cross in the shape of a T. MATTHEW—A knife or dagger. MARK—A winged lion. LUKE—A bull. ST. JOHN—An eagle. PAUL—An elevated sword or two swords in saltire. JOHN THE BAPTIST—An Agnus Dei. STEPHEN—With stones in his lap.

THE ORDERS AND THEIR APPLICATION.

By ALFRED W. S. CROSS, M. A., F. R. I. B. A., and ALAN E. MUNBY, M. A.

THE SETTING UP OF AN ORDER.

(To be studied in connection with Plates I., II., III., IV. and V.)

The sequence followed in setting up an Order will be found to influence, to some extent, the rapidity and facility with which it can be accomplished. An outline of the method of procedure may, therefore, prove useful.

Usually the height of the Order is fixed by circumstances, as, for example, when it is to be applied to a given storey of a building.

The total height having been settled, draw the limiting horizontal lines and then set out the vertical centre lines of the columns, thus dividing the frontage to be treated into bays appropriate to the exigencies of the design and having due regard to the correct intercolumniation of the Order adopted. If a pedestal is to be placed under the column, cut off one-fifth of the total height for it, and cut off one-fifth or one-sixth of the remainder (measured from the top limiting horizontal line) for the vertical height of the entablature; the intervening space gives the height of the column, including its cap and base. If no pedestal is to be used, divide the whole of the given height into five or six parts, cut off one of these parts, from the top, for the entablature, and the remainder gives the height of the column.

The Column. Since some of the dimensions of the entablature are in terms of the diameter of the column, the latter should be next developed. The term "diameter of the column" refers always to its greatest diameter—namely, that of the shaft just above the lower cincture. This dimension is one-seventh to one-tenth of the height between the soffit of the entablature and the top of the pedestal, or lower limit of the Order in the absence of a pedestal. If the centre lines of the piers do not represent the centres of the columns, as, for instance, when coupled columns are used, the centre line of one of the columns must now be decided upon and the diameter of the Order symmetrically disposed horizontally across it. A semi-diameter is then cut off, from the bottom of the column, for the height of the base, and it should be noticed that this—except in the Tuscan and alternative Doric Orders—does not include the fillet at the base of the shaft, the members above the upper torus being reckoned as part of the shaft, as are also the astragal and fillet below the necking of the capital of the column. The plinth and lower torus of the base project one-third and the upper torus one-fifth of a semi-diameter beyond the lower circumference of the shaft. The leading lines for the base having thus been obtained, cut off by a horizontal line the height of the capital from the top of the column, and (except in the Ionic Order) again below it, a height equal to one-sixth of a semi-diameter for the astragal and fillet below the necking.

The semi-diameter of the shaft at one-third of its height from the bottom is then divided into five or six parts, and four or five of these parts are taken as a semi-diameter at the top, below the astragal. The shaft may now be completed, the entasis being usually made to start from the greater diameter, one-third up the shaft, below which point it is a true cylinder until the cincture at the base is reached. This is the best method to adopt in the case of small scale drawings. Where large detailed drawings are in question the diameter may be alternatively divided at the base of the shaft instead of at one-third of

its height, and the entasis extended throughout the whole length. The completion of the shaft enables the projection of the capital to be marked off, and also that of the astragal and fillet, which is equal to their combined height.

The Entablature. The development of the entablature can now be proceeded with, the architrave, frieze and cornice being ruled off horizontally and the members of each inserted (see dimensions). The projections for a returned end or section are obtained from the upper diameter of the shaft. The lowest member of the architrave, and also the frieze, lie vertically over the circumference of this upper end of the shaft. The projection of the cornice beyond the frieze line is equal to its height, except in the Doric Order, in which the projection is one-third more than its height of one diameter. Further rules dealing with minor projections and the position of the modillions, dentils, etc., will be supplied by a study of the plates and tabulated dimensions.

Pedestal. Finally, the pedestal, if any, should be divided vertically into four parts: the lower part is ruled off for the height of the plinth, one-third of the second part for the height of the base, and one-half of the top part for that of the cap. The projection of the die is equal to that of the base of the column, and the plinth and the cap of the pedestal extends beyond this for a distance equal to the height of the base of the pedestal previously obtained.

The above dimensions will all be found in the subjoined table, which represents an endeavour to bring together, in a form suitable for reference, sufficient information to make any glaring disproportion impossible.

A few of the minor divisions are only approximations; they will, however, be found to be sufficiently accurate for any but large detail drawings, in which it is not desirable to destroy all individuality by rigorous mechanical rules.

On the left hand will be found the dimension required and, in the intermediate column the fraction for each Order of the previously ascertained unit given in the right-hand column.

Plate I.

Plate I. represents the four Orders drawn to a common vertical height.

The pedestal may or may not be required and, if used, it is to be regarded as an addition to the Order, the relative dimensions of the parts of which are not altered by its removal or introduction.

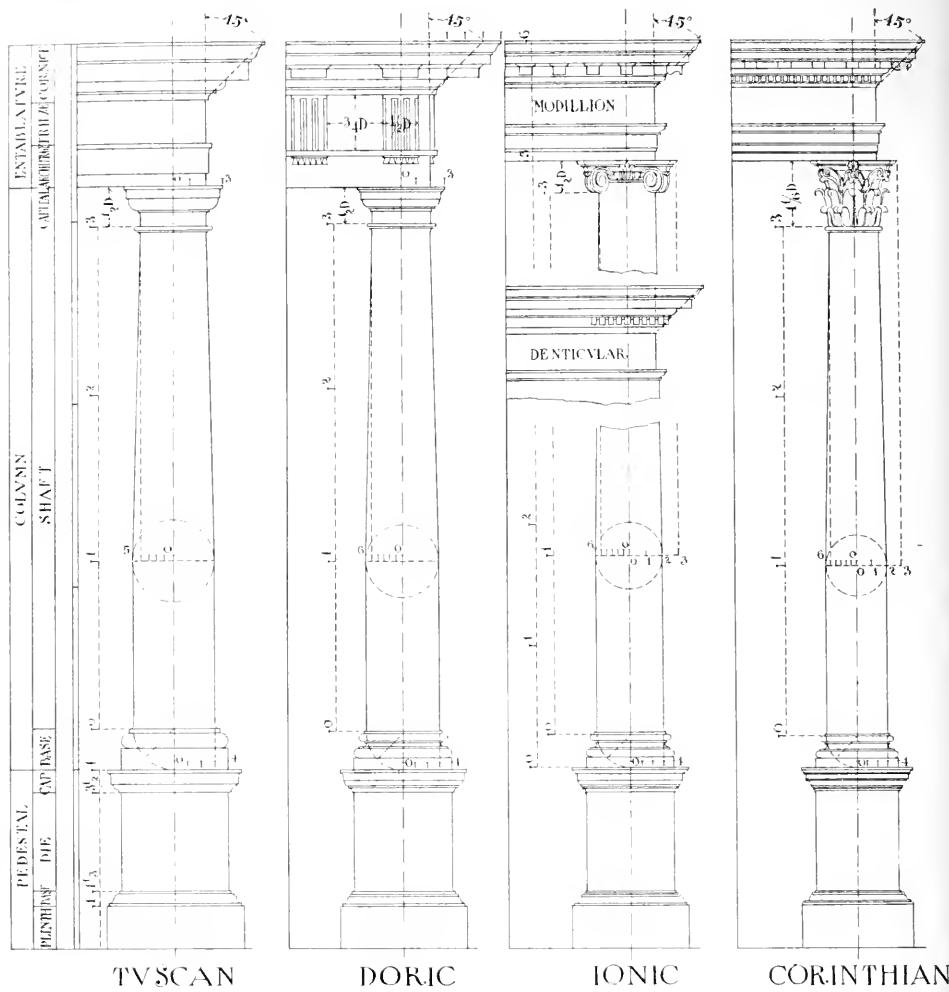
The diameter of the column (by which is meant the diameter of the shaft following its lower cincture) is the ruling dimension from which most of the others are obtained, and the smaller circumference of the top of the shaft always coincides with the frieze line from which all the projections of the entablature are set out.

In judging the value of such projections it should be borne in mind that in execution the higher vertical faces of the composition will usually be much foreshortened to the observer and that there will be a consequent increase in the comparative value of neighboring projections.

A perusal of the table will indicate those dimensions which all the Orders have in common, but for convenience of reference they are further summarized thus:

Height of Pedestal, $\frac{1}{5}$ total height of Order.

PLATE I.



Height of Plinth, $\frac{1}{4}$ height of Pedestal.

Height of Pedestal Base, $\frac{1}{3}$ height of Pedestal Plinth.

Height of Pedestal Cap, $\frac{1}{2}$ height of Pedestal Plinth.

Projection of Cap and Plinth, $\frac{1}{3}$ height of Pedestal Plinth.

Projection of Corona over Die, $\frac{3}{4}$ projection of Pedestal Cap.

Height of Column Base, $\frac{1}{2}$ diameter of Column.

Projection of Base over Shaft, $\frac{1}{3}$ semi-diameter of Column.

Pilasters. The general proportions allotted to the columns of the Orders apply also to pilasters, which may be regarded as columns square on plan, but almost universally deeply engaged. The projection of pilasters must be regulated by circumstances. If impost mouldings or other projections stop upon them, as on the inner wall of an arcade, these projections must be sufficient to take the mouldings, and if they line with engaged columns crowned by an entablature, they must have a projection similar to the columns, and therefore in such cases never less than a semi-diameter. Apart from these

considerations, the projection should be about one-fourth of the diameter. Pilasters may be fluted or plain; if the former, the flutes should be, as far as possible, the same size as those of the adjoining columns, and always an odd number.

* * *

On plain faces 7 flutes (occasionally 9) are used, and therefore in the above case 4 flutes (or 5) would be employed on each side of the re-entering angle. The returned sides of pilasters should never be fluted unless the projection is as much as half of a diameter. The diameter assigned to a pilaster will be that of a column (if any) used in conjunction with it. The shaft may or may not be diminished.

If the pilaster stand alone it is best formed with the same top and bottom diameter, but if a column stand in front of it then it should be diminished to the same extent as the column. Entasis is not usually given to pilasters.

Unless columns and pilasters are monoliths the shafts should be built up of three drums and not two, as a central joint, unless exceptionally well executed, has a very disagreeable appearance.

"Practical Notes for Architectural Draughtsmen : The Orders and their Application."
Tabulated Dimensions of the Orders, Arranged Progressively as Required for Use.

| Dimension required. | | Tuscan. | Doric. | Ionic. | Corinthian. | Dimension 3. |
|--------------------------------|---|---------|--------|--------|-------------|--|
| No Pedestal | Height of Entablature | 1 | 1 | 1 | 1 | Total height of Order. |
| With Pedestal | (Height of Pedestal.) | 1 | 1 | 1 | 1 | " |
| | (Height of Entablature) | 1 | 1 | 1 | 1 | Height of Order less Pedestal. |
| THE COLUMN. | | | | | | Height of Order less Entablature and Pedestal. |
| Diameter of Shaft | 1 | 1 | 1 | 1 | 1 | Diameter of Shaft. |
| Height of Base | 1 | 1 | 1 | 1 | 1 | Height of Base. |
| Base Plinth | 1 | 1 | 1 | 1 | 1 | " less Plinth. |
| Lower Torus | 1 | 1 | 1 | 1 | 1 | " lower Torus. |
| Upper Torus | 1 | 1 | 1 | 1 | 1 | " |
| Upper Torus and fillet under | 1 | 1 | 1 | 1 | 1 | Diameter of Shaft. |
| Capital | 1 | 1 | 1 | 1 | 1 | Height of Capital (Corinthian less Abacus). |
| Necking | 1 | 1 | 1 | 1 | 1 | To 1st Abacus. |
| | Top of Neck to top of Ovolo | 1 | 1 | 1 | 1 | To 2nd Ab. |
| | Abacus | 1 | 1 | 1 | 1 | about 3 and lead to abacus about 1 |
| | Astral and fillet | 1 | 1 | 1 | 1 | abacus about 1 |
| | Fillet below Astragal | 1 | 1 | 1 | 1 | " |
| | Projection of Base beyond Diameter | 1 | 1 | 1 | 1 | Semi-diameter of Shaft. |
| | " Upper Torus | 1 | 1 | 1 | 1 | Height of Astragal and Fillet. |
| | Diminution of Shaft at Top | 1 | 1 | 1 | 1 | Semi-diameter of Shaft at Top. |
| | Projection of Cap over Shaft at Top | 1 | 1 | 1 | 1 | Semi-diameter of Shaft. |
| | Cap over Shaft at Base | 1 | 1 | 1 | 1 | " |
| | Bed at top of Shaft | 1 | 1 | 1 | 1 | " |
| THE ENTABLATURE. | | | | | | Height of Entablature. |
| Height of Architrave | 1 | 1 | 1 | 1 | 1 | 1 |
| Frieze | 1 | 1 | 1 | 1 | 1 | 1 |
| Cornice | 1 | 1 | 1 | 1 | 1 | 1 |
| Fillet and Cyma | 1 | 1 | 1 | 1 | 1 | Cornice. |
| Corona and Fillet over | 1 | 1 | 1 | 1 | 1 | " |
| Base of Corona to top of Ovolo | 1 | 1 | 1 | 1 | 1 | " |
| Top of Ovolo to Frieze | 1 | 1 | 1 | 1 | 1 | " |
| | Total projection of Architrave over top face of Shaft | 1 | 1 | 1 | 1 | " |
| | " of Cornice over Frieze | 1 | 1 | 1 | 1 | " |
| | Inset of Corona from top of Cornice | 1 | 1 | 1 | 1 | Total projection of Architrave. |
| | Length of Medallions (or Mutuals) | 1 | 1 | 1 | 1 | Height of Cornice. |
| | " Breadth of Medallions (or Dentils) | 1 | 1 | 1 | 1 | " Fillet and Cyma of Cornice. |
| | 1/2 Space between Medallions (or Dentils) | 1 | 1 | 1 | 1 | Diameter of Column. |
| THE PEDESTAL. | | | | | | " |
| Height of Plinth | 1 | 1 | 1 | 1 | 1 | Height of Pedestal. |
| Base | 1 | 1 | 1 | 1 | 1 | Plinth. |
| Cyma of Base | 1 | 1 | 1 | 1 | 1 | Base. |
| Fillet below Base | 1 | 1 | 1 | 1 | 1 | Fillet above Cyma. |
| Cap | 1 | 1 | 1 | 1 | 1 | Height of Plinth. |
| | Base of Corona to top of Cap | 1 | 1 | 1 | 1 | Cap. |
| | Projection of Cap and Plinth over Die | 1 | 1 | 1 | 1 | Base of Pedestal. |
| | " Corona of Cap over Die | 1 | 1 | 1 | 1 | Projection of Cap over Die. |

Note. The "Diameter" is always the greatest diameter of the drum of the Column. M. refers to the Modillion Cornice. D. to the alternative Dental Cornice.

PLATE 2.

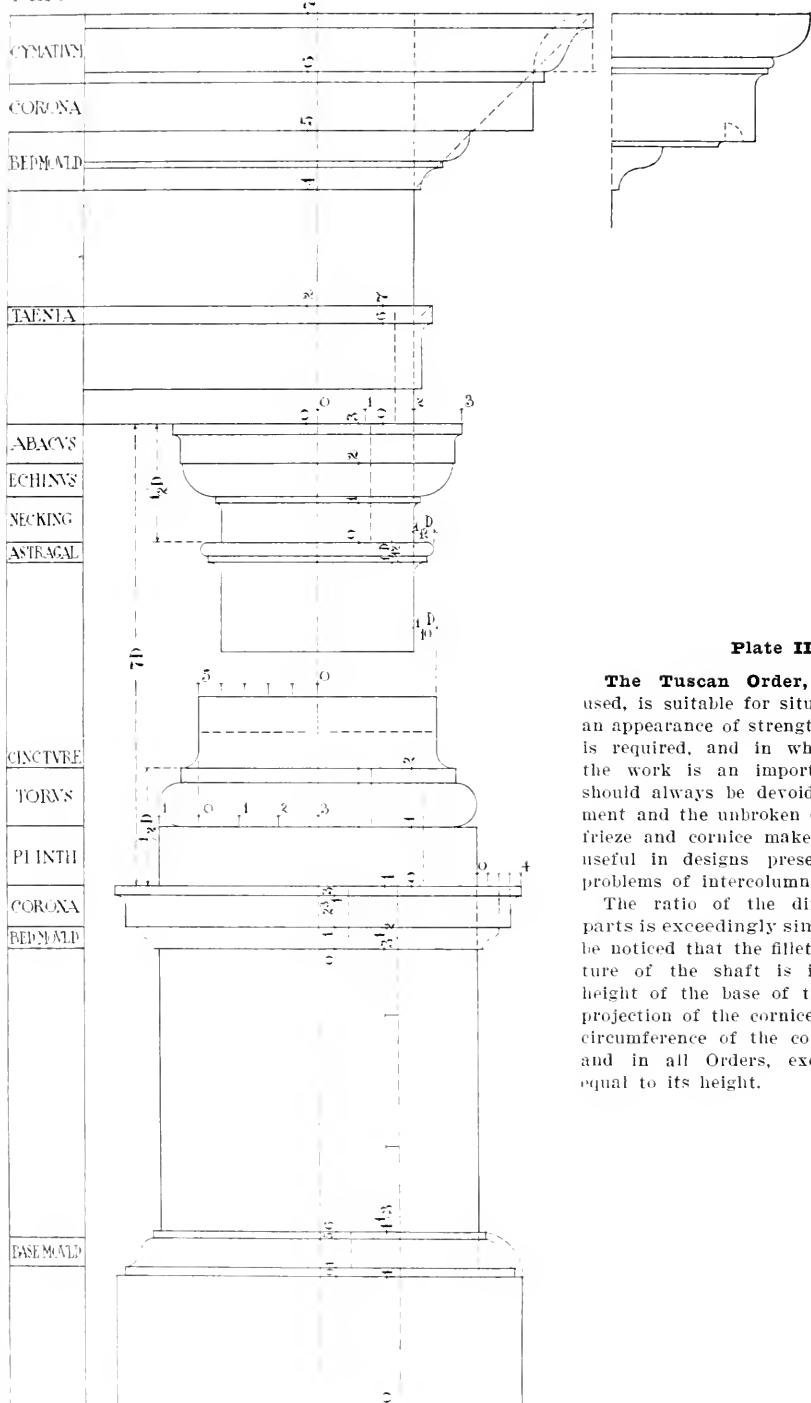
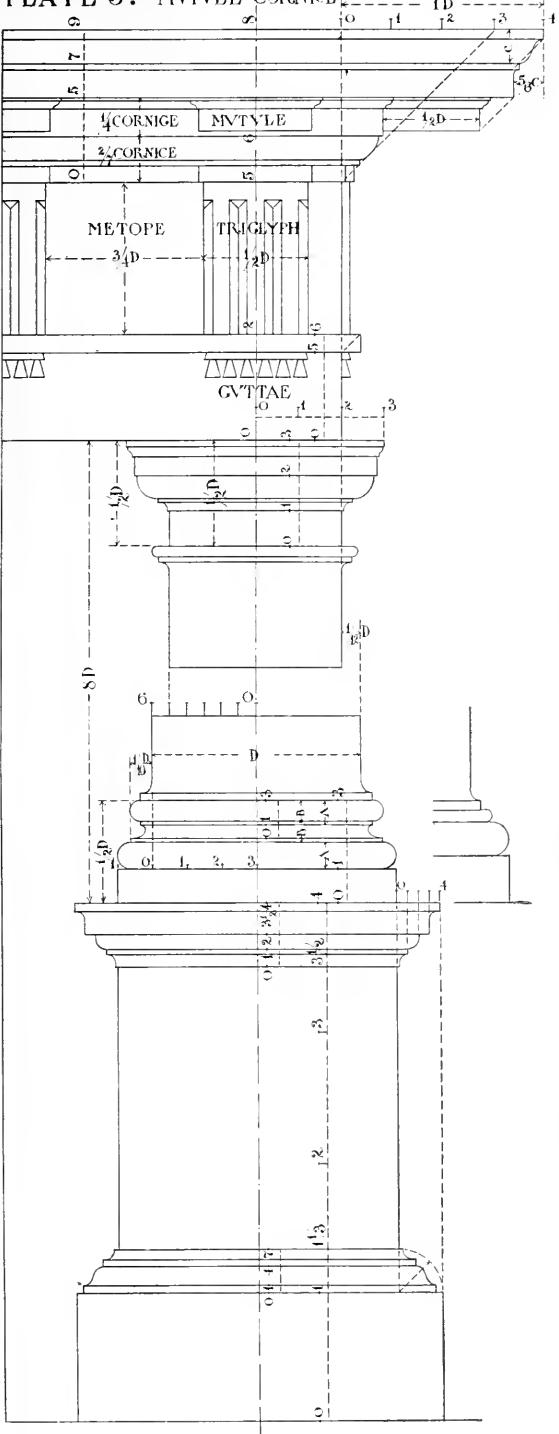


Plate II.

The Tuscan Order, though seldom used, is suitable for situations in which an appearance of strength and simplicity is required, and in which the cost of the work is an important factor. It should always be devoid of any enrichment and the unbroken character of the frieze and cornice makes it particularly useful in designs presenting awkward problems of intercolumniation.

The ratio of the dimensions of its parts is exceedingly simple. It should be noticed that the fillet below the cincture of the shaft is included in the height of the base of this Order. The projection of the cornice over the upper circumference of the column is, in this and in all Orders, except the Doric, equal to its height.

PLATE 3. MUTULE CORNICE



DENTICULAR CORNICE

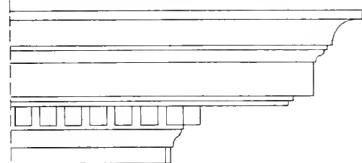


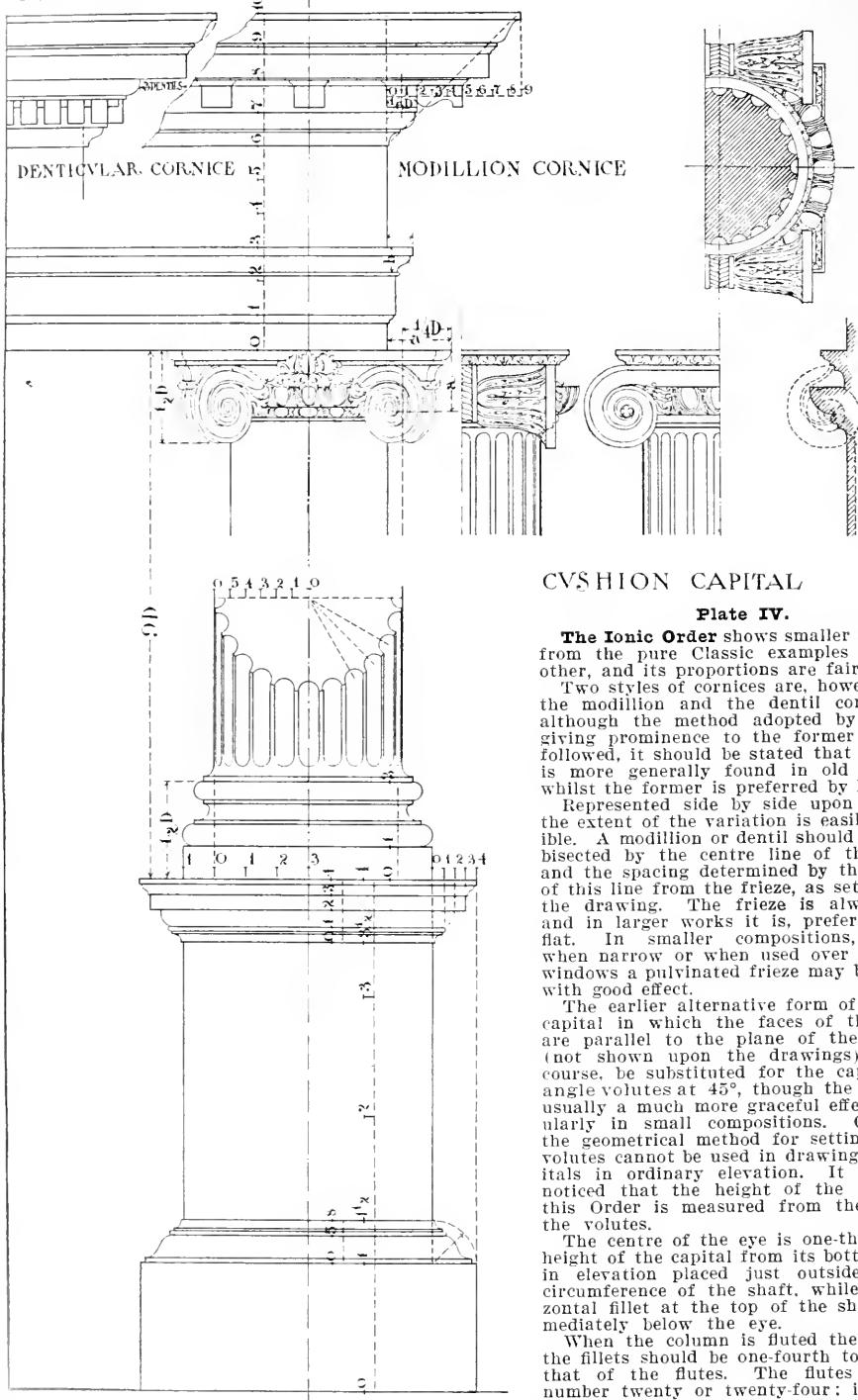
Plate III.

The **Doric Order** is always effective when used in lower storeys, arcades, and door and window openings, but owing to the triglyphs upon the frieze, which must fall centrally over the columns, it is the most difficult to deal with when spacing is in question.

The dimensions of the cornice do not lend themselves to any simple ratio and its projection is always greater than that adopted for the other Orders. The 45° line from the top of the frieze at once gives the bed mould of the mutule course, and one-third of the height of the cornice added to the top projection of this guiding line gives the total projection, while the mutules are one-half a diameter in side elevation. Some considerable modifications of the Order, as here represented, will be found to exist in many recognised examples. Occasionally the mutules are dispensed with, and their bed mould is cut to form a dentil course, as in the Theatre of Marcellus. The cyma crowning the cornice is often replaced by a cavetto, while the Doric base (shown alternatively on the plate) sometimes replaces the more graceful attic base. When this base is used, the upper fillet should be included in the height of the base, as in the Tuscan Order.

DORIC

PLATE 4.



CVS HION CAPITAL

Plate IV.

The Ionic Order shows smaller variations from the pure Classic examples than any other, and its proportions are fairly simple.

Two styles of cornices are, however, used, the modillion and the dentil cornice, and although the method adopted by Gibbs of giving prominence to the former has been followed, it should be stated that the latter is more generally found in old examples whilst the former is preferred by Palladio.

Represented side by side upon the plate the extent of the variation is easily discernible. A modillion or dentil should always be bisected by the centre line of the column and the spacing determined by the distance of this line from the frieze, as set out upon the drawing. The frieze is always plain and in larger works it is, preferably, kept flat. In smaller compositions, however, when narrow or when used over doors and windows a pulvinated frieze may be adopted with good effect.

The earlier alternative form of the Ionic capital in which the faces of the volutes are parallel to the plane of the elevation (not shown upon the drawings) may, of course, be substituted for the capital with angle volutes at 45° , though the latter has usually a much more graceful effect, particularly in small compositions. Of course, the geometrical method for setting out the volutes cannot be used in drawing such capitals in ordinary elevation. It should be noticed that the height of the capital in this Order is measured from the soffit of the volutes.

The centre of the eye is one-third of the height of the capital from its bottom and is in elevation placed just outside the top circumference of the shaft, while the horizontal fillet at the top of the shaft is immediately below the eye.

When the column is fluted the width of the fillets should be one-fourth to one-third that of the flutes. The flutes generally number twenty or twenty-four: in the latter case the simple method of setting them out on plan, as shown on the drawing, will be found of service.

The attic base is always used with the Ionic Order.

IONIC

PLATE 5.

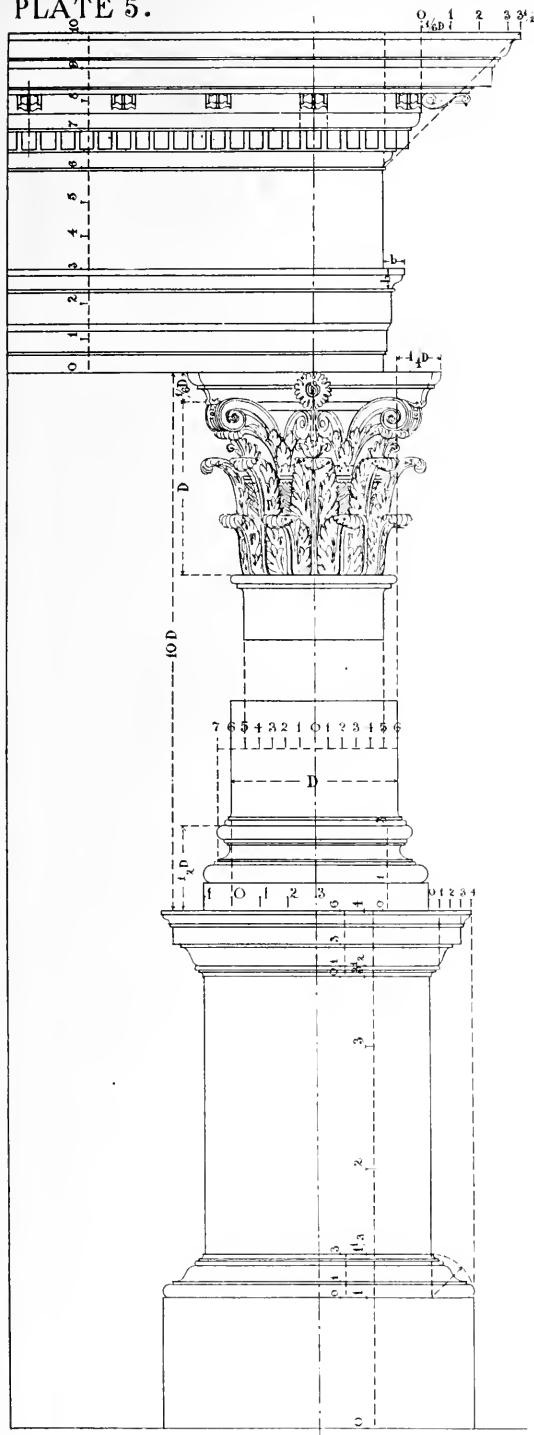


Plate V.

The Corinthian Order has been represented with considerable variations from the original type.

The Ionic entablature was often used by the ancients, supported by Corinthian columns, and the Corinthian cornice itself, though here represented with a dentil band, is often found without one. No general rule appears to exist for spacing the modillions or for their dimensions, the ratio of the width of the modillion to the space between two of them varying from $1:1\frac{1}{2}$ to $1:2\frac{1}{2}$, and again the number of the dentils between the modillions varies from 2 to 5 in different examples.

Both features should be symmetrically placed with reference to one another and to the centre line of the column, a point often neglected. To secure this result the following method is recommended:—Draw a modillion one-sixth of the diameter of the column in width, arranged symmetrically over the centre line of the column. Place another with its outside edge three and a half times its width within the total projection of the cornice, and thus obtain the spacing between the blocks. Divide the distance between two modillion centres into 15 parts, give two to a dentil, to be placed symmetrically under a modillion, and one to each space between the dentils, which will be found to bring the inside edge of the last dentil before the return, on the frieze line.

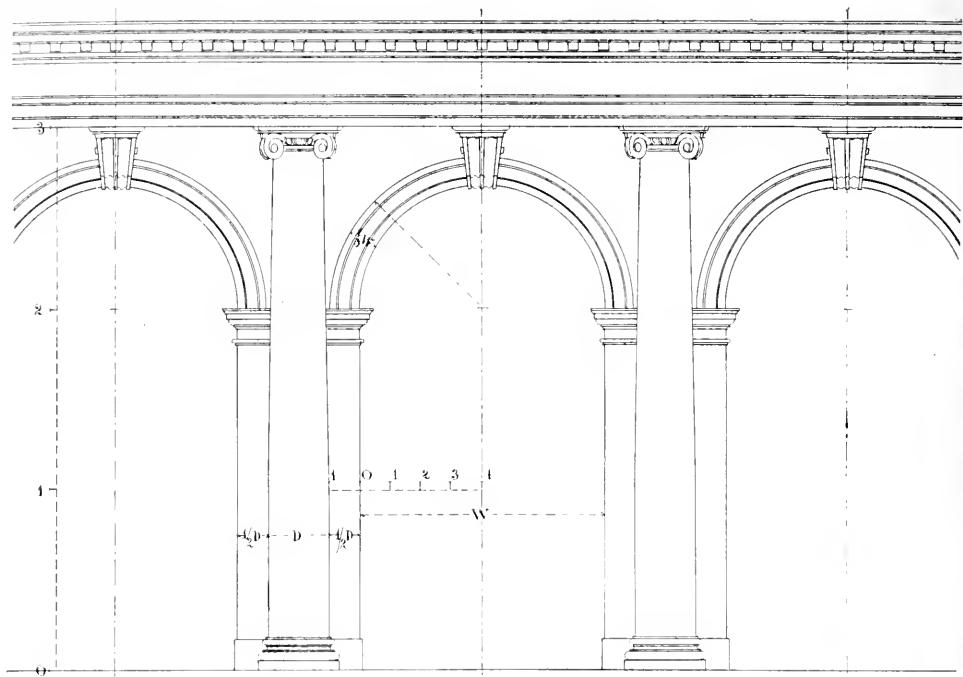
The form and projection of the leaves of the capital are largely matters of individual taste, but the general method of their arrangement will be evident after examining the drawing. It may, however, be noted that the eye of the volute is just outside the lower circumference of the shaft, and that the tiers of leaves divide the capital below the abacus into three approximate equal horizontal sections.

The column may or may not be fluted as in the Ionic Order.

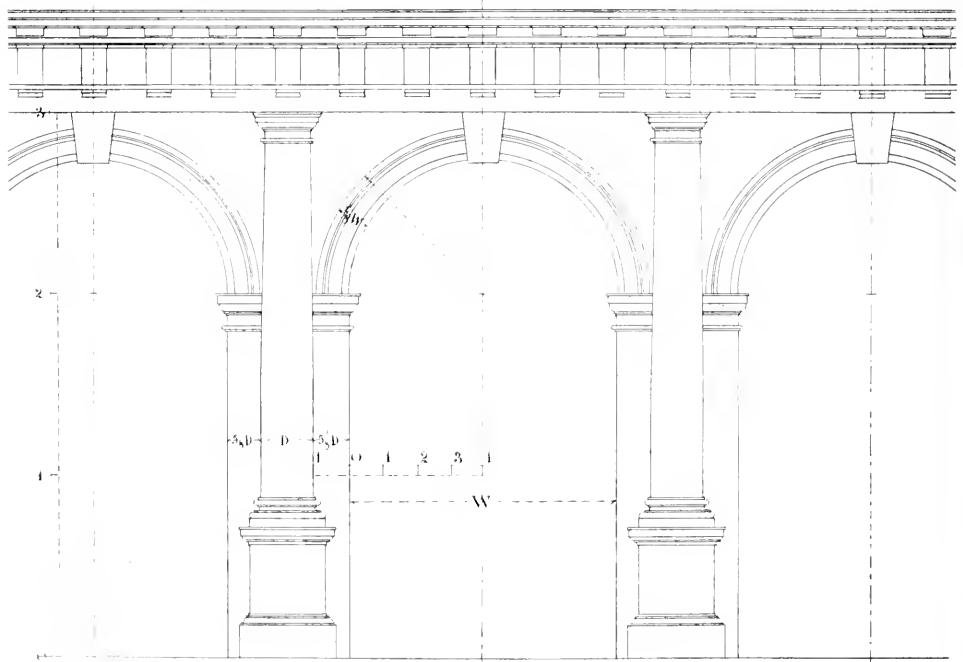
The attic base, as used in the Ionic Order, is very generally employed—in fact, it is often preferable to adopt it, omitting the additional mouldings shown, for the sake of variety, on the drawing.

CORINTHIAN

PLATE 6.



IONIC



DORIC

Plate VI.

The relations and dimensions given in this and similar subsequent plates must, therefore, be looked upon as necessarily somewhat elastic. At the same time, such dimensions as are given should not be disregarded, but considered in the light of proportions to be attained as far as the exigencies of the plan will admit.

The spacing of arcading dealt with in this plate should be governed by the height of the space to be treated, and it will be found that the best effects are obtained when the widths of the

seen that a relation exists between the diameter of the column, the width of the pilaster, and the width of the opening. Again, the diameter of the column relatively to the opening will be influenced by the presence, or absence, of a pedestal to the Order. The summary shown, collected from Gibbs's work, giving the dimensions to be aimed at in order to comply with the above relations, will be found useful:

The height of the impost should always be about two-thirds of the height from the ground to the soffit of the architrave of the Order, whether a pedestal is in use or not.

Diameter of Column = 1.

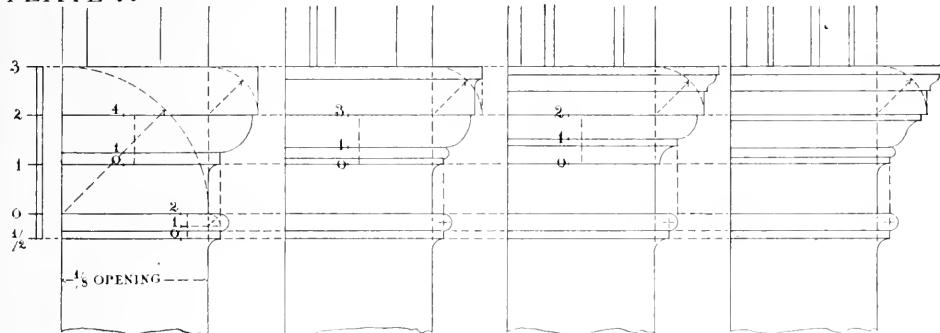
| | Tuscan. | | Doric. | | Ionic. | | Corinthian. | |
|-------------------------------|---------------|-----------------|-----------------|-----------------|---------------|-----------------|------------------|-----------------|
| | No Ped. | With Ped. | No Ped. | With Ped. | No Ped. | With Ped. | No Ped. | With Ped. |
| Width of bay centre to center | 6 | 7 | 6 $\frac{1}{4}$ | 7 $\frac{1}{2}$ | 6 | 7 $\frac{1}{2}$ | 6 $\frac{5}{12}$ | 8 $\frac{1}{6}$ |
| Width of one pilaster | $\frac{1}{2}$ | $\frac{2}{3}$ | $\frac{1}{2}$ | $\frac{5}{8}$ | $\frac{1}{2}$ | $\frac{5}{8}$ | $\frac{1}{6}$ | $\frac{7}{10}$ |
| Width of opening | 4 | 4 $\frac{2}{3}$ | 4 $\frac{3}{4}$ | 5 $\frac{1}{4}$ | 4 | 5 $\frac{1}{4}$ | 4 $\frac{1}{3}$ | 5 $\frac{5}{6}$ |

openings approximate to half of their height, and when the total width of the piers lies between one-half and two-thirds of that of the opening.

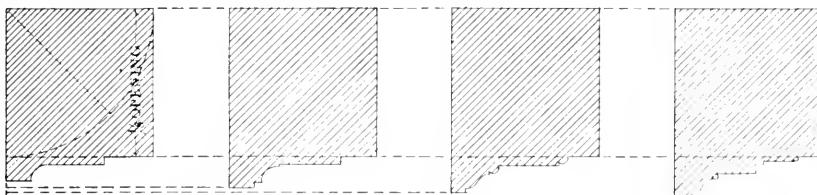
The spacing must also be considered in reference to the Order employed, so that when triglyphs, or modillions, are placed centrally over the columns their proper spacing may be interfered with as little as possible. It will thus be

The archivolt or moulding running round the arch should be the same width as the pilaster (less any necessary clearance for the mouldings)—that is, about one-eighth of the width of the opening, which should also be the height of the impost cap to the bottom of the necking. Further details as to the members will be found on Plate VII.

PLATE 7.



IMPOSTS AND ARCH MOULDS



TUSCAN

DORIC

IONIC

CORINTHIAN

Plate VII. Impost Mouldings.

Details are here given of impost mouldings, with their archivolts, suitable for the different Orders. The divisions of the imposts are all simple and similar in each example, the height of the corona and of its mouldings above, if any, being equal to the height of the mouldings below, which, again, are equal to the necking. The bead and fillet below the necking are one-sixth of the height of the impost, the bead being double the height of the fillet. The projection of the impost beyond the line of the pilaster is equal to the height of the corona and member over in the

first two Orders, while the projection of the corona itself is equal to this height in the last two.

The pilaster is square on plan, and, therefore, the plan of the archivolt is represented by this square upon which the mouldings are placed. An examination of these mouldings will show that they resemble the architraves given for their respective Orders, and their forms admit of similar variations. It will be noticed that the innermost face is always in the plane of the face of the pilaster, while the projection of the moulding at the extrados increases from about one-quarter the width of the whole archivolt in the Tuscan to one-third in the Corinthian Order.

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SUBJECT INDEX.

System of Classification for Filing Data, Drawings, Plates, Catalogues, Etc., in Architects' and Contractors' Offices.

INTRODUCTION.

The decimal system of classification was devised and elaborated by Mr. Melvil Dewey, formerly director of the New York State Library. This system was intended primarily for the use of librarians in the classification and arrangement of books and pamphlets, but it was soon found that the system furnished also a simple and effective means of classifying, indexing and filing literary matter of all kinds. Engineers have found it useful for indexing technical data and information, catalogs, reports, card systems, drawings, etc., and it has been found equally useful by manufacturing and business concerns.

Much of the following information is taken from the University of Illinois Engineering Experiment Station, Bulletin No. 9, prepared by L. P. Breckenridge, Professor of Mechanical Engineering, and G. A. Goodenough, Associate Professor of Mechanical Engineering, and Bulletin No. 13 by N. Clifford Ricker, D. Arch. Professor of Architecture.

EXPLANATION OF THE DECIMAL SYSTEM.

The essential characteristic of the Dewey System is its method of division and subdivision. The entire field of knowledge is divided into nine chief classes numbered by the digits from 1 to 9. Matter of too general a nature to be included in any of these classes is put into a tenth class and indicated by 0. The following are the primary classes of the Dewey System:

- 0 GENERAL WORKS
- 1 PHILOSOPHY
- 2 RELIGION
- 3 SOCIOLOGY
- 4 PHILOLOGY
- 5 NATURAL SCIENCE
- 6 USEFUL ARTS
- 7 FINE ARTS
- 8 LITERATURE
- 9 HISTORY

Each of these classes is again divided into nine divisions, with a tenth division for general matter, and each division is separated into nine sections. The sections are again sub-divided and the process may be carried as far as desired.

It is thought that this system will be especially valuable to architects for classifying drawings, catalogs, reports and technical data. Our space is too limited to publish the complete work, nor is it desirable. Should any one be sufficiently interested to go into the matter thoroughly, they should have Mr. Dewey's complete text on the subject. In order to make the application of the system clear in the briefest possible way, the miscellaneous information contained in this book has been assumed to comprise a small architect's library and has been classified according to the Dewey System. It is hoped that this will make clear the practical application to architects' libraries, both large and small. In succeeding years, we hope to be able to publish a more extensive relative index in which the items of the classification are arranged alphabetically, the one at present published only covering the items of miscellaneous information contained in this book, with some of the more important general topics. We are particularly concerned as practitioners of the profession of architecture with divisions 6 and 7, "Useful Arts" and "Fine Arts," comprising the following subject numbers:

600 USEFUL ARTS

- 610 MEDICINE
- 620 ENGINEERING
- 630 AGRICULTURE
- 640 DOMESTIC ECONOMY
- 650 COMMUNICATION AND COMMERCE.
- 660 CHEMICAL TECHNOLOGY
- 670 MANUFACTURES
- 680 MECHANIC TRADES
- 690 BUILDING

Omitting all sub-divisions of this topic, with the exception of 690 "Building," we publish the sub-divisions of same. As distinguished from "Architectural Construction," "Building" has to do more particularly with the processes of construction and matters pertaining to trades and materials involved in the construction of buildings should be more properly classified under "Building," while matters as to types and component architectural parts are more properly classified under Architectural Construction.

690 BUILDING — MATERIALS — TRADES.

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- Engineering of Construction.**
- SUMMARIES OR COMPENDS.**
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- History of Building Materials.**
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| .7 | Relief Work. Lineresta. Stamped Leather, etc. | | |
| .8 | Other branches. Carpets and Rugs. | | |
| .9 | CAR AND SHIP BUILDING. | | |
| 700 | FINE ARTS. | | |
| 701 | PHILOSOPHY. THEORIES. UTILITY. AESTHETICS. | | |

- .91 Cast-Iron Structures; .92, Wrought-Iron Structures; .93, Steel Structures; .94, Composite Structures; .95, Steel and Wood; .96, Steel and Stone; .97, Steel and Ceramic; .971, Steel and Brick; .972, Steel and Tile; .973, Steel and Terra Cotta; .98, Steel and Glass; .99, Wood and Glass.
- 722, 723, 724 **HISTORY OF ARCHITECTURE.** Classify modern American buildings of importance in the History of Architecture under 724; generally all other American buildings under 725 to 728 inclusive.
Modern foreign buildings are usually placed under 721, unless of special importance as examples of the class or purpose, when they are to be treated like American buildings.
- 722. **Ancient or Primitive Architecture.**
 - .0 Prehistoric.
 - .02 England.
 - .04 France.
 - .07 Russia.
 - .08 Scandinavia.
 - 722.11 China.
 - .12 Japan.
 - .13 Korea.
 - .14 Philippine.
 - 722.2 Egypt.
 - .3 Phoenician, Jewish, etc.
 - .4 India, East.
 - .5 Western Asia.
 - .7 Roman.
 - .8 Grecian.
 - .9 Other Ancient Styles.
 - 723. Mediaeval, Christian, Mohammedan.
 - .1 Early Christian.
 - .2 Byzantine.
 - 723.3 Mohammedan.
 - .4 Romanesque.
 - 723.5 Gothic.
 - 724. Modern.
 - .1 Renaissance; .111, Scotland; .115, Ireland; .12, England; .121, Elizabethan; .122, Jacobean; .123, 17th Century; .124, 18th Century; .131, Germany; .136, Austria; .14, France; .141, Francis I; .142, Henry IV; .143, Louis XIV; .144, Louis XVI; .145, Empire; .151, Italy; .151, Cinquecento; .152, High Renaissance; .153, Decadence; .154, Rococo; .161, Spain; .169, Portugal; .17, Russia; .171, Canada; .172, Mexico; .173, United States; .1, Old Colonial; .2, Spanish Colonial; .178, South America; .1, Brazil; .2, Argentina; .3, Chili; .4, Bolivia; .5, Peru; .6, Ecuador; .7, Venezuela; .9, Paraguay; .18, Scandinavia; .181, Norway; .185, Sweden; .189, Denmark; .19, Minor Countries; .192, Holland; .193, Belgium; .194, Switzerland; .199.
 - .2 Classical Revival. Grecian.
 - .3 Gothic Revival.
 - .4 Tudor Gothic Revival.
 - .5 Queen Anne Revival.
 - 724.6 Neo Grec.
 - .7 Half-Timber Swiss.
 - .8 Romanesque Revival.
 - .9 Other Recent Styles.
 - 725. **PUBLIC BUILDINGS.**
 - .1 Administrative. Governmental.
 - .11 Capitols. Houses of Parliament.
 - .12 Ministries of War, State, etc.
 - .13 City and Town Halls. Bureaus. Public Offices.
 - .14 Custom Houses. Bonded Warehouses. Excise Offices.
 - .15 Court Houses. Record Offices.
 - .16 Post Offices. General and Special.
 - .17 Official Residences. Palaces of Rulers.
 - .18 Barracks. Armories. Police Stations.
 - .181 National Barracks.
 - .182 State Barracks.
 - .183 Armories. Barracks.

- .184 National Police Buildings.
- .185 State Police Buildings.
- .186 City Police Buildings.
- .19 Engine Houses. Fire Alarm Stations.
- .2 **Business and Commercial.**
 - .21 Stores, Wholesale and Retail.
 - .22 Mixed Store, Office, and Apartment Buildings.
 - .23 Office Buildings. Telegraph. Insurance.
 - .24 Banks. Safe Deposit. Savings.
 - .25 Exchanges. Boards of Trade.
 - .26 Markets.
 - .27 Cattle Markets. Stock Yards. Abattoirs.
 - .29 Other Business Buildings.
- .3 **Transportation and Storage.**
 - .31 Railway Passenger Stations.
 - .311 Small (country) Stations.
 - .312 Large (city) Stations.
 - .313 Union Stations.
 - .314 Stations on two levels.
 - .315
 - .316
 - .317 Street-car Stations.
 - .318 Elevated R. R. Stations.
 - .319 Underground R. R. Stations.
 - .32 Railway Freight Houses.
 - .33 Railway Shops, Round Houses, Car Houses, Tanks, Stores.
 - .34 Dock Buildings. Wharf Boats and Houses.
 - .35 1. Warehouses; 2, Cold Storage; 3, Safe Deposit Storage.
 - .36 Elevators, Grain.
 - .37
 - .38
 - .39 Other.
- .4 **Manufactories.**
 - .41 Textile Factories or Mills. Wool, Cotton, Silk.
 - .42 Breweries. Malteries. Distilleries.
 - .43 Foundries. Machine Shops. Iron and Steel Works.
 - .44 Wood-working Mills. Furniture Factories.
 - .45 Carriage and Car Factories.
 - .46 Paper Mills.
 - .47 Mills for Flour, Meal, Feed, etc.
 - .48 Pottery, Glass, Terra Cotta, Brick Works.
 - .49 Other Manufactories.
- 725.5 **Hospitals and Asylums.** See also 725.6. Reformatories.
 - .51 Sick and Wounded. Eye and Ear. Incurables. Lying-in.
 - .52 Insane.
 - .53 Idiotic. Feeble-minded.
 - .54 Blind. Deaf and Dumb.
 - .55 Paupers. Almshouses.
 - .56 Aged.
 - .57 Children. Orphans.
 - .58 Foundling.
 - .59 Soldiers' Homes.
- .6 **Prisons and Reformatories.**
 - .61 State Prisons. Penitentiaries.
 - .62 Jails. Cell Houses.
 - .63 Reformatories for Adults. Houses of Correction.
 - .64 Reform Schools.
 - .65 Washingtonian Homes. Inebriate Asylums.
- .7 **Refreshment. Baths. Parks.**
 - .71 Cafés. Restaurants.
 - .72 Saloons.
 - .73 Baths: Warm, Medicated, Turkish, Russian.
 - .74 Swimming Baths.
 - .75 Buildings for Watering Places, Spas, etc.
 - .76 Buildings for Parks and Streets. Public Comfort Stations.
- .8 **Recreation.**
 - .81 Music Halls.
 - .811 Auditoriums.
 - .82 Theatres. Opera Houses.
 - .83 Halls for Lectures, Readings, etc.
 - .84 Bowling Alleys. Billiard Saloons.

| | |
|-----|--|
| .85 | Gymnasiums. Turn Halls. |
| .86 | Skating Rinks. Bicycle Rinks. |
| .87 | Boat Houses. |
| .88 | Riding Halls and Schools. |
| .89 | Shooting Galleries. |
| .9 | Other Public Buildings. |
| .91 | Exhibition Halls. |
| .92 | Temporary Halls. Tabernacles. Wigwams. |
| .93 | Workingmen's Clubs and Institutes. |
| .94 | Town Squares. |

726 ECCLESIASTICAL AND RELIGIOUS.

| | |
|------|--|
| .1 | Temples. |
| .2 | Mosques. |
| .3 | Synagogues. |
| .4 | Chapels. Sunday-school Buildings. |
| .5 | Churches. |
| .51 | Frame. |
| .52 | Brick or Stone. |
| .521 | Small Audit., seating less than 600. |
| .522 | Large Audit., seating more than 600. |
| .6 | Cathedrals. |
| .7 | Monasteries. Convents. Abbeys. |
| .8 | Mortuary. Cemetery Chapels. Receiving Vaults. Tombs. |
| .9 | Other. Y. M. C. A., etc. |

727 EDUCATIONAL AND SCIENTIFIC.

| | |
|-----|---|
| .1 | Schools. |
| .11 | Ward and Grammar. |
| .12 | High Schools. |
| | Study and Recitation Rooms. Not including dormitory or boarding. |
| .2 | Academies. Seminaries. Boarding Schools. |
| .3 | Colleges. Universities. |
| .4 | Professional and Technical Schools. |
| .5 | Law, Theology, etc. |
| | Laboratories: Physical, Chemical. See 542.1, Biological, etc. Zoological and Botanic Gardens. See also 590.7 and 580.7. |
| .6 | .1, Museums. .2, Herbariums. See 580.7. |
| .7 | .1, Art Galleries. .2, Studios. |
| .8 | Libraries. See 022, Library Buildings. |
| .9 | Other. Learned Societies, etc. |

728 RESIDENCES.

| | |
|-------|--|
| .1 | Tenement Houses. |
| .11 | City Homes of Poor. |
| .12 | Country Homes of Poor. |
| .13 | Cités Ouvrieres. |
| .2 | Collective Dwellings. |
| .21 | Flats; one family to the floor. |
| .211 | Small Flats less than 8 rooms. |
| .212 | Large Flats, 8 rooms or more. |
| .22 | Apartment Houses; more than one family to floor. |
| .221 | Five Suites or Less. |
| .222 | Six Suites or More. |
| .2221 | Elevator Service. |
| .2222 | No Elevator Service. |
| .3 | City Houses. Mansions. Palaces. |
| .31 | Between party-walls. Stone. |
| .32 | Between party-walls. Brick. |
| .33 | Between party-walls. Partly wood. |
| .34 | Semi-detached, including end houses in city blocks. Stone. |
| .35 | Semi-detached, including end houses in city blocks. Brick. |
| .36 | Semi-detached, including end houses in city blocks. Partly wood. |
| .37 | Detached. Stone. |
| .38 | Detached. Brick. |
| .39 | Detached. Partly wood. |

| | |
|-----|---|
| .4 | Club Houses. Buildings for Secret Societies. |
| .5 | Hotels. |
| .51 | City Hotels. |
| .52 | Summer Resorts. |
| .53 | Country Inns. |
| .6 | Village and Country Homes. |
| .61 | Village Dwellings. On small lots. |
| .62 | Stone. |
| .63 | Brick. |
| .64 | Concrete or stucco. |
| .65 | Part masonry, part wood. |

| | |
|-----|---|
| .66 | All wood. 1, less than 7 rooms; 2, 7-12 rm; 3, 13 rm or over. |
| .67 | Farm Houses. |
| .68 | Laborers' Cottages. 1, Frame; 2, Masonry. |
| .7 | Seaside and Mountain Cottages. Chalets. |
| .81 | Castles. |
| .82 | Chateaux. |
| .83 | Manor Houses. |
| .84 | Villas. |
| .85 | Log Houses. |
| .86 | Bungalows. |
| .91 | Out-Buildings. |
| .92 | Porters' Lodges. |
| .93 | Servants' Quarters. |
| .94 | Kitchens and Laundries. |
| .95 | .1, Stables. .2, Carriage Houses. .3, Garages. |
| .96 | Barns, Granaries. |
| .97 | Dairies. |
| .98 | Ice Houses. |
| .99 | Conservatories. Green Houses. Grottoes. |

729 ARCHITECTURAL DESIGN AND DECORATION.

| | |
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| .1 | The Elevation. |
| .11 | Composition; .12, Distribution; .13, Proportion; .14, Light and Shade; .15, Perspective effect; .15, .16, .17, .18, .19. |
| | For projection of shadows and graphics of light and shadow see 515.63 and 515.7. |
| .2 | The Plan. |
| .21 | Elements required; .22, Distribution; .23, Proportion; .24, .25, .26, .27, .28, .29. |
| .3 | Elementary Forms. For construction of these forms see 721. |
| .31 | Walls. Mouldings. Cornices. .32, Piers, Columns, Pilasters, Pedestals and the Orders. Colonnades. .33, Arches and Arcades. .34, Vaults and Domes. .35, Roof. Spires. Dormers. .36, Towers. .37, Gables and Pediments. .38, Doors and Windows. Bays. Oriels. .39, Stairs and Balustrades. See also 515.83, Stereotomy; 604.8, Building. |
| .4 | Painted Decoration. |
| .5 | Decoration in Relief. |
| .6 | Incrustation and Veneering. |
| .7 | Mosaic and Marble. |
| .71 | Mosaic Ceilings; .72, Mosaic Walls; .73, Mosaic Floors; .74, Other Mosaic designs; .75, .76, .77, .78, .79. |
| .8 | Stained Glass Design. For technical processes see 666.1; for history see 748. |
| .9 | Architectural Accessories and Fixed Furniture. |
| | Altars, Pulpits, Tribunes, Dais Thrones, (Ecclesiastical.) |
| | Seating for Public Buildings. |
| | Benches, Settees. |
| | Domestic Chairs, Tables, Couches, Stools, etc. |
| .94 | Buffets. |
| .95 | Mantels. Overmantels. Andirons. |
| .96 | Steel Furniture. |
| .97 | Window Shades. |
| .98 | .1, Organs. .2, Pianos. |
| .99 | Lighting Fixtures. |
| .730 | SCULPTURE. |
| .731 | MATERIALS AND METHODS. |
| .732 | ANCIENT. |
| .733 | GREEK AND ROMAN. |
| .734 | MEDIEVAL. |
| .735 | MODERN. |
| .736 | CARVING. SEALS. DIES. GEMS. CAMEOS. |
| .737 | NUMISMATICS. COINS. MEDALS. |
| .738 | POTTERY. PORCELAIN. |
| .739 | BRONZES. BRASSES. BRIC-A-BRAC. |

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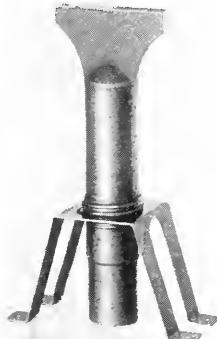
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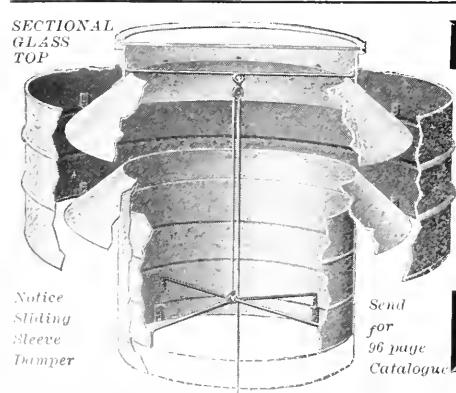
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INDEX TO BUILDING ORDINANCE.

(See Pages 65 to 179.)

NOTE:—In this index, matters relating to Officers, Appointments, Etc., come first, then the Classes from I to VIII, and lastly the General Provisions, each alphabetically arranged under their respective headings.

**Officers, Inspectors, Appointments, Powers,
Duties, Permits, Etc.**
(Sections 199 to 250, inc.)

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Scully Steel & Iron Co., Halsted and Fulton Sts.

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American Bronze Foundry Co., 73rd and Woodlawn Ave.

American Iron & Wire Works, 575-581 Carroll Ave.

Brown Bros. Mfg. Co., 22d St. & Campbell Av.

Heath-Johnson Co., 127 E. Ontario St.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Schweizer & West Mfg. Co., 86-94 North Ada St.

Smith, F. P. Wire & Iron Works, 100 Lake St.

Standard Company, The, Railway Exchange

Voss, Frederick, 617 to 621 Austin Av.

BEAMS AND COLUMNS—IRON AND STEEL

Anderson, A. F., 5836 Loomis St.

Butler St. Foundry & Iron Co., 3422 Butler St.

Halsted, Joseph, Co., 388 W. Randolph St.

Holmes, Pyott & Co., 13 N. Jefferson St.

Jackson, George W., Inc., 169-179 W. Jackson Blvd.

Jennet Bridge & Iron Wks., 3541 Shields Av.

Kenwood Bridge Co., First Nat'l Bank Bldg.

Morava Construction Co., 1243 Marquette Bldg.

Muth, Chr., 428 Blue Island Av.

Scully Steel & Iron Co., Halsted & Fulton Sts.

Smith, F. P. Wire & Iron Works, 100 Lake St.

South Halsted St. Iron Works, 125 Adams St.

Union Foundry Works, First Nat'l Bank Bldg.

Vierling, McDowell & Co., 23rd St. and Stewart Av.

Worden-Allen Co., 115 Adams St.

BELT AND HAND POWER ELEVATORS.

Altizer & Prince Co., 51 Michigan St.

Otis Elevator Company, 9 Jackson Blvd.

Reedy, J. W. Elevator Mfg. Co., 91 Illinois St.

BELTING.

Western Roofing & Supply Co., 2357 La Salle

BILLIARD TABLES.

Brunswick-Balke-Collender Co., 263 Wabash Ave.

BILLIARD ROOM SUPPLIES.

Brunswick-Balke-Collender Co., 263 Wabash Ave.

BLACK PLATE.

Scully Steel & Iron Co., Halsted and Fulton.

BLAST FURNACES.

Mohr, John & Sons, 32 Illinois St.

BLOWER REGULATORS.

Davis, G. M., Regulator Co., 144-146 Milwaukee Av.

BLUE AND BLACK PRINTING.

American Blue Print Paper Co., 102-104 Van Buren St. and Railway Exchange Bldg.

Crofoot, Nielsen & Co., 167 E. Washington St.

Dietzgen, Eugene Co., 181 Monroe St.

Keuffel & Esser Co., 111 Madison St.

United States Blue Print Paper Co., 263 La Salle St.

BOILER AND GENERAL CASTINGS.

Butler St. Foundry & Iron Co., 3422 Butler St.

BOILER AND PIPE COVERING.

Chapman, Richard W., Co., 2656-8 N. Hamlin Ave.

Chicago Fire Proof Covering Co., 113 Randolph St.

Garden City Sand Co., The, 134 Washington Johns-Manville Co., H. W., 173 Randolph St.

Western Roofing & Supply Co., 2357 La Salle

BOILERS.

Arcade Steam Heating Co., 153 Kinzie St.

Illinois Malleable Iron Co., 537 Diversey Blvd.

Kaestner, Chas. & Co., 241-261 S. Jefferson St.

Kehm Bros. Co., 13-15 W. Kinzie St.

Mohr, John & Sons, 32 Illinois St.

Mueller, L. J., Furnace Co., 40 Dearborn St.,

and Milwaukee, Wis.

Richardson & Boynton Co., 20 Lake St.

Union Iron Works, 1403 Fisher Bldg.

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BOILERS—MARINE AND TUBULAR.

Mohr, John & Sons, 32 Illinois St.

BOILER SETTINGS.

Warwick Construction Co., 324 Dearborn St.

BOILERS—STEAM AND HOT WATER.

Deppmann, A. & Co., 212 Illinois St.

Deppmann, L., 1539 Lincoln Ave.

Dillzer, Fred, 48 Dearborn St.

Hanley-Casey Co., 37 Ohio St.

Illinois Malleable Iron Co., 537 Diversey Blvd.

Kehm Bros. Co., 13-15 W. Kinzie St.

Kewanee Boiler Co., 35 Michigan Av.

Kilander, A. & Co., 141 S. Clinton St.

Kroeschell Bros. Co., 55 Erie St.

McMaster-Carr Supply Co., 174 Lake St.

Mueller, L. J., Furnace Co., 40 Dearborn St.,

and Milwaukee, Wis.

Norton, F. J., 8 North State St.

Purves Heating Co., 215 Fifth Av.

Richardson & Boynton Co., 20 Lake St.

Union Iron Works, 1403 Fisher Bldg.

Wills & Smith, 5938 S. Halsted St.

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BOILER SUPPLIES AND MACHINERY.

Scully Steel & Iron Co., Halsted and Fulton Sts.

BOLTS, NUTS, IRON AND STEEL.

Scully Steel & Iron Co., Halsted and Fulton Sts.

BONDS.

Joyce & Co., 217 La Salle St.

Marsh & McLennan, 159 La Salle St.

BOWLING ALLEYS.

Brunswick-Balke-Collender Co., 263 Wabash Ave.

BRASS AND COPPER TUBES.

Scully Steel & Iron Co., Halsted and Fulton Sts.

BRASS AND IRON—ARCHITECTURAL.

American Bronze Foundry Co., 73rd and Woodlawn Ave.

American Iron & Wire Works, 575-581

Carroll Ave.

Brown Bros. Mfg. Co., 22d St. & Campbell Av.

Butler St. Foundry & Iron Co., 3422 Butler St.

Chicago Ornamental Iron Works, 37th St. and Stewart Av.

Heath-Johnson Co., 127 E. Ontario St.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Smith, F. P. Wire & Iron Works, 100 Lake St. Standard Company, The, Railway Exchange Voss, Frederick, 617 to 621 Austin Av.

BRASS GOODS.

Heath-Johnson Co., 127 E. Ontario St.

BRASS, IRON AND WIRE.

Halsted, Joseph, Co., 388 W. Randolph St. Hanke Iron & Wire Works, 1243-47 Fillmore St.

Smith, F. P. Wire & Iron Works, 100 Lake St. Standard Company, The, Railway Exchange Vierling, McDowell & Co., 23rd St. and Monadnock Blk., Chicago.

BREWERY AND MALT HOUSE CONSTRUCTION.

Climax Co., 1005 Tacoma Bldg. Kaestner, Chas. & Co., 241-261 S. Jefferson St.

BRICK BUILDING RAISERS AND MOVERS.

Friestedt, L. P., Co., 1526-28 Tribune Bldg. Sheeler, H., Co., 716 Chamber of Commerce.

BRICK—COMMON.

Knickerbocker Ice Co., 171 La Salle St. Moulding, Thomas Co., Chamber of Commerce. National Brick Co., 84 La Salle St. Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

BRICK—ENAMELED.

Bonner & Marshall Co., 1107 Chamber of Com. Hydraulic Press Brick Co., 3rd Floor Chamber of Commerce Bldg. Jenkins & Reynolds Co., The, 1210 Cham. Com. Kimbell, S. S., Brick Co., 304 Cham. of Com.

BRICK—FIRE.

Garden City Sand Co., The, 134 Washington Harbison-Walker Refractories Co., 115 Adams St.

Jenkins & Reynolds Co., The, 1210 Cham. Com. Moulding, Thomas Co., Chamber of Commerce. Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

BRICK—ORNAMENTAL AND PLAIN.

Harbison-Walker Refractories Co., 115 Adams St.

BRICK—PAVING.

Bonner & Marshall Co., 1107 Chamber of Com. Garden City Sand Co., The, 134 Washington Jenkins & Reynolds Co., The, 1210 Chamber of Commerce. Moulding, Thomas Co., Chamber of Commerce.

BRICK—PRESSED.

Bonner & Marshall Co., 1107 Chamber of Com. Harbison-Walker Refractories Co., 115 Adams St.

Hydraulic Press Brick Co., 3rd Floor Chamber of Commerce Bldg.

Jenkins & Reynolds Co., The, 1210 Cham. Com. Kimbell, S. S., Brick Co., 304 Cham. of Com. Moulding, Thomas Co., Chamber of Commerce. Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

BRICK—QUARTZITE.

Harbison-Walker Refractories Co., 115 Adams St.

BRICK—SAND MOLD.

Bonner & Marshall Co., 1107 Chamber of Com. Hydraulic Press Brick Co., 3rd Floor Chamber of Commerce Bldg.

Jenkins & Reynolds Co., The, 1210 Chamber of Commerce.

Kimbell, S. S., Brick Co., 304 Cham. of Com.

BRIDGES—STEEL.

Westcott & Ronneberg, 1107-8, 188 Madison St. Worden-Allen Co., 115 Adams St.

BRIDGES AND ROOFS.

Climax Co., 1005 Tacoma Bldg.

Jackson, George W., Inc., 169-179 W. Jackson Blvd.

Jennet Bridge & Iron Wks., 3541 Shields Av. Kenwood Bridge Co., First Nat'l Bank Bldg.

Morava Construction Co., 1243 Marquette Bldg.

Strobel Steel Construction Co., 1744-1748 Monadnock Blk.

Worden-Allen Co., 115 Adams St.

BRONZE WORK.

American Bronze Foundry Co., 73rd and Woodlawn Ave.

Brown Bros. Mfg. Co., 22d St. & Campbell Av.

Chicago Ornamental Iron Works, 37th St. and Stewart Av.

Smith, F. P. Wire & Iron Works, 100 Lake St. Standard Company, The, Railway Exchange

BUILDERS' HARDWARE.

Cobb, Whyte & Laemmer Co., 45 Clark St. Michel's, N., Hardware, 1661 Lincoln Ave.

Orr & Lockett Hardware Co., 71-73 Randolph. Reading Hardware Co., 105 Lake St.

BUILDING LOANS.

Baird & Warner, 90 La Salle St.

Greenebaum Sons, 59 Clark St.

BUILDING MATERIALS.

American Asphaltum & Rubber Co., 234 Michigan Ave.

Chicago Terra Cotta Co., 1208 Chamber of Commerce Bldg.

Climax Co., 1005 Tacoma Bldg.

Garden City Sand Co., The, 134 Washington

Knickerbocker Ice Co., 171 La Salle St.

Northwestern Terra Cotta Co., The, 1415 Railway Exchange Bldg.

Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

BUILDING PAPERS.

Barrett Mfg. Co., 164 Dearborn St.

Johns-Manville Co., H. W., 173 Randolph St.

Paine Lumber Co., Chamber of Commerce.

Western Roofing & Supply Co., 2357 La Salle

BUILDING RAISERS AND MOVERS.

Friestedt, L. P., Co., 1526-28 Tribune Bldg. Riedeau, L. J., & Son, 928 Stock Ex. Bldg. Sheeler, H., Co., 716 Chamber of Commerce.

CABINET WORK.

Brunswick-Balke-Collender Co., 263 Wabash Ave.

Chicago Bank & Office Fixture Co., 677-679 W. Van Buren St.

Harty Bros. & Harty Co., W. 21st and Loomis Sts.

Schweizer & West Mfg. Co., 86-94 North Ada St.

CANOPIES—IRON AND BRONZE.

American Bronze Foundry Co., 73rd and Woodlawn Ave.

Standard Company, The, Railway Exchange

CAREONIC ENGINES.

Ever Ready Mfg. Co., 1403 Fisher Bldg.

CARPENTER CONTRACTORS.

Alling Construction Co., 72 Madison St. Anderson A. & E., 512 Tacoma Bldg.

Bent, E. M. Co., 506 Security Bldg.

Bulley & Andrews, 411, 115 Dearborn St.

Cadenhead & Morow Co., 79 Dearborn St.

Chapman, Chas., 84 La Salle St.

Clark, C., Everett Co., 1405, 100 Washington St.

Davis, John E., 620 Chestnut St., St. Louis.

Ericsson, Henry, Co., 84 La Salle St.

Ewen, John M., Co., The, The Rookery.

Gilsdorff, Henry, & Sons, 163 Randolph St.

Gindele, Chas. W., Co., 3333 La Salle St.

Grace, Wm. Company, 1408 Wabash Av.

Griffiths, John & Son, 1009-1011 Merchants

Loan & Trust Bldg.

Hinschliff, Geo., 188 Madison St.
Ledgerwood, A. J. C., 84 La Salle St.
Mavor, William, Co., 164 Dearborn St.
Meiling & Walther, 84 La Salle St.
Mueller, Paul P. F., 109 Randolph St.
Nelson, F. P. & Son, 715-716 Cham. of Com.
Noel Construction Co., 109 La Salle St.
Nollau & Wolff Mfg. Co., 1705 Fullerton
Olson Bros. Co., 6501 Peoria St.
Paschen Bros., 115 Dearborn St.
Peterson, W. F., 79 Dearborn St.
Regnell, B. J. Co., 131 La Salle St.
Scharmer, Jacob, 215 Dearborn St.
Schweizer & West Mfg. Co., 86-94 North
Ada St.
Shedden, James, Co., 92 La Salle St.
Snyder, J. W., Suite 1009-11, 160 Washington St.
Strandberg, E. P., Co., 108 La Salle St.
Stresenreuter Bros., 614 Chamber of Commerce.
Thompson-Starrett Co., Fisher Bldg.
Todd, James, & Co., 145 La Salle St.
Warren Construction Co., The (Wm. H.
Warren, Prest.), Monadnock Bldk.
Wells Bros. Company, 1014 Monadnock Bldk.
Wilson & Wyld, 140 Dearborn St.
Zadeck, B. M. Co., 811, 135 Adams St.

CARVING.

Dux, Joseph, 132 W. Jackson Blvd.

CAST IRON FENCE POSTS.

Reder Foundry Co., Canalport Av., Sangan-
mon & Johnson Sts.

CASTINGS—GENERAL.

Butler St. Foundry & Iron Co., 3422 Butler
St.
Reder Foundry Co., Canalport Av., Sangan-
mon & Johnson Sts.

CASUALTY INSURANCE.

Marsh & McLennan, 159 La Salle St.

CEILINGS—COPPER PLATED.

Illinois Metal Ceiling & Supply Co., 23 Lake
St.

CEILINGS—EMBOSSED STEEL.

Illinois Metal Ceiling & Supply Co., 23 Lake
St.

CEILINGS—ORNAMENTAL STEEL.

Illinois Metal Ceiling & Supply Co., 23 Lake
St.

Knisely Bros., 28th Place and 5th Av.

Krefting, E., 119 W. Van Buren St.

McFarland, J. C. Co., 27th St. & 5th Ave.

Staar, Frank, 615 N. Halsted St.

Sykes Steel Roofing Co., 112-129 W. 19th Pl.

CEILINGS—SUSPENDED, GROINED AND ARCHED.

Illinois Terra Cotta Lumber Co., 439 The
Rookery.

National Fire Proofing Co., 115 Adams St.
Roebling Construction Co., The, Stock Ex-
change Bldg.

CEMENT.

Atlas Portland Cement Co., First Nat. Bank
Bldg.

Chicago Portland Cement Co., Stock Exc. Bldg.
de Smet, Geo. W., Chamber of Commerce
Bldg.

Garden City Sand Co., The, 134 Washington

Jenkins & Reynolds Co., The, 1210 Cham. Com.

Knickerbocker Ice Co., 171 La Salle St.

Marquette Cement Mfg. Co., 204 Dearborn.

Meacham & Wright Co., 805-10 Corn Ex-
Bank Bldg.

Peerless Portland Cement Co., Union City,

Mich.; Chicago Office, 92 La Salle St.

Schultz, F., 16th and Ruble Sts.

Wolverine Portland Cement Co., Coldwater,

Mich.

Wisconsin Lime and Cement Co., 607 Cham-
ber of Commerce.

CEMENT—AMERICAN AND IMPORTED.

Garden City Sand Co., The, 134 Washington
Jenkins & Reynolds Co., The, 1210 Chamber
of Commerce.

Meacham & Wright Co., 805-10 Corn Ex-
Bank Bldg.

CEMENT—HYDRAULIC.

Garden City Sand Co., The, 134 Washington
Jenkins & Reynolds Co., The, 1210 Chamber
of Commerce.

Knickerbocker Ice Co., 171 La Salle St.

Moulding, Thomas Co., Chamber of Commerce.

CEMENT—MANUFACTURERS.

Atlas Portland Cement Co., First Nat'l Bank
Bldg.

Chicago Portland Cement Co., Stock Exc. Bldg.
de Smet, Geo. W., Chamber of Commerce

Bldg.

Marquette Cement Mfg. Co., 204 Dearborn.
Peerless Portland Cement Co., Union City,
Mich., Chicago Office, 92 La Salle St.
Wolverine Portland Cement Co., Coldwater,
Mich.

CEMENT PAVING AND FLOORS.

American Asphaltum & Rubber Co., 234
Michigan Ave.

Blome, Rudolph S. Co., 79 Dearborn St.

Climax Co., 1005 Tacoma Bldg.

Hoeffer & Co., Chamber of Commerce Bldg.
Pleas Concrete Construction Co., 503—160
Washington St.

Standard Concrete Construction Co., 184 La
Salle St.

CEMENT—PORTLAND.

Atlas Portland Cement Co., First Nat'l Bank
Bldg.

Chicago Portland Cement Co., Stock Exc. Bldg.
de Smet, Geo. W., Chamber of Commerce

Bldg.

Garden City Sand Co., The, 134 Washington
Jenkins & Reynolds Co., The, 1210 Cham. Com.

Knickerbocker Ice Co., 171 La Salle St.

Marquette Cement Mfg. Co., 204 Dearborn.
Meacham & Wright Co., 805-10 Corn Ex-
Bank Bldg.

Moulding, Thomas Co., Chamber of Commerce.
Peerless Portland Cement Co., Union City,
Mich., Chicago Office, 92 La Salle St.
Wolverine Portland Cement Co., Coldwater,
Mich.

Wisconsin Lime and Cement Co., 607 Cham-
ber of Commerce.

CEMENT SIDEWALKS, PAVING AND FLOORS.

American Asphaltum & Rubber Co., 234
Michigan Ave.

Blome, Rudolph S. Co., 79 Dearborn St.

Climax Co., 1005 Tacoma Bldg.

Hoeffer & Co., Chamber of Commerce Bldg.
Pleas Concrete Construction Co., 503—160
Washington St.

Simpson Construction Co., 704 Cham. of Com.
Standard Concrete Construction Co., 184 La
Salle St.

CEMENT—UTICA HYDRAULIC.

Garden City Sand Co., The, 134 Washington
Jenkins & Reynolds Co., The, 1210 Chamber
of Commerce.

Meacham & Wright Co., 805-10 Corn Ex-
Bank Bldg.

CEMENT AND CONCRETE CONSTRUC- TION.

Alling Construction Co., 72 Madison St.
American Asphaltum & Rubber Co., 234
Michigan Ave.

Blome, Rudolph S. Co., 79 Dearborn St.

Climax Co., 1005 Tacoma Bldg.

Ferro Concrete Construction Co., The, Stock
Exchange Bldg.

Hoeffer & Co., Chamber of Commerce Bldg.
National Water Proof Co., 234 Michigan
Ave.

Pleas Concrete Construction Co., 503—160
Washington St.

Simpson Construction Co., 704 Cham. of Com.
Standard Concrete Construction Co., 184 La
Salle St.

Warwick Construction Co., 324 Dearborn St.

CHAINS.

Scully Steel & Iron Co., Halsted and Fulton Sts.

CHEMISTS.

Hunt, Robert W. & Co., 1121 The Rookery.

CHIMNEY TOPS.

Chicago Terra Cotta Co., 1208 Chamber of Commerce Bldg.

Northwestern Terra Cotta Co., The, 1415 Railway Exchange Bldg.

CLOCKS—TOWER.

Johnson Service Co., 93 Lake St.

CLOTHES DRYERS.

American Laundry Machinery Mfg. Co., The, 80 Franklin St.

Chicago Dryer Co., 381 Wabash Ave.

Troy Laundry Machinery Co., 23rd and La Salle Sts.

CLUSTERS, WIRELESS—STANDARD AND SEPARABLE.

Benjamin Electric Mfg. Co., 42 W. Jackson Blvd.

Western Electric Co., 259 S. Clinton St.

COAL CHUTES.

Ritter, Emil W. Co., The, 40 Dearborn St.

COAL WINDOWS.

Ritter, Emil W. Co., The, 40 Dearborn St.

COAL DOCK TOWERS.

Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.

COAL HANDLING MACHINERY FOR POWER PLANTS.

Jeffrey Mfg. Co., Monadnock Blk. and Columbus Brothers, 705 Bloomingdale Av.

Weller Mfg. Co., 118 East North Ave.

COLD DRAWN STEEL TRIM.

Dahlstrom Metallic Door Co., Monadnock Blk. and Jamestown, N. Y.

COOLING SYSTEMS FOR BUILDINGS.

Narowetz, Louis, 13-15 W. Kinzie St.

Thomas & Smith, 17-19 S. Carpenter St.

Webster, Warren & Co., 1510 Monadnock Bldg.

COMPOSITION FOR EXTERIOR AND INTERIOR—ORNAMENTAL.

Builders & Decorators Supply Co., 152 Veder St.

Architectural Decorating Co., 643 S. Jefferson.

Decorators' Supply Co., The, Archer Av. & Leo St.

Plastic Relief Mfg. Co., The, 298 N. Halsted St.

CONCRETE CONSTRUCTION.

American Asphaltum & Rubber Co., 234 Michigan Ave.

American System of Reinforcing, 189 La Salle St.

Climax Co., 1005 Tacoma Bldg.

Ferro Concrete Construction Co., The, Stock Exchange Bldg.

Hoeffer & Co., Chamber of Commerce Bldg.

Lock Bar Steel Concrete Co., Com'l Nat. Bk. Bldg.

McNulty Bros., 1455 Railway Exchange Bldg.

National Water Proof Co., 234 Michigan Ave.

Pleas Concrete Construction Co., 503—160 Washington St.

Raymond Concrete Pile Co., 135 Adams St.

Roebling Construction Co., The, Stock Exchange Bldg.

Simpson Construction Co., 704 Cham. of Com.

CONCRETE FIRE PROOFING.

Alling Construction Co., 72 Madison St.

Climax Co., 1005 Tacoma Bldg.

Emerson, H. L., 1206 Chamber of Commerce

Ferro Concrete Construction Co., The, Stock Exchange Bldg.

Hoeffer & Co., Cham. of Com. Bldg.

Pleas Concrete Construction Co., 503—160 Washington St.

Roebling Construction Co., The, Stock Exchange Bldg.

Warwick Construction Co., 324 Dearborn St.

CONCRETE FILES.

Raymond Concrete Pile Co., 135 Adams St.

CONCRETE—REINFORCED.

Alling Construction Co., 72 Madison St.

Climax Co., 1005 Tacoma Bldg.

Emerson, H. L., 1206 Chamber of Commerce

Ferro Concrete Construction Co., The, Stock Exchange Bldg.

Hoeffer & Co., Chamber of Commerce Bldg.

Pleas Concrete Construction Co., 503—160 Washington St.

Warwick Construction Co., 324 Dearborn St.

Westcott & Ronneberg, 1107-8, 188 Madison St.

Calumet Steel Co., Com'l Nat. Bank Bldg.

Lock Bar Steel Concrete Co., Com'l Nat. Bk. Bldg.

CONCRETE REINFORCING BAR STEEL.

American Steel & Wire Co., Com'l Nat. Bk. Bldg.

American System of Reinforcing, 189 La Salle St.

Calumet Steel Co., Com'l Nat. Bank Bldg.

Lock Bar Steel Concrete Co., Com'l Nat. Bk. Bldg.

CONCRETE—SLAG.

III. Improvement & Ballast Co., 115 Adams St. City.

CONDUITS AND FITTINGS.

Western Electric Co., 259 S. Clinton St.

CONSOLES AND MANTELS.

Harty Bros. & Harty Co., W. 21st and Loomis Sts.

Pickens, Edward, Co., 479 Wabash Ave.

CONTRACTORS AND BUILDERS.

Alling Construction Co., 72 Madison St.

Anderson A. & E., 512 Tacoma Bldg.

Bent, E. M. Co., 506 Security Bldg.

Bulley & Andrews, 411, 115 Dearborn St.

Cadenhead & Morow Co., 79 Dearborn St.

Chapman, Chas., 84 La Salle St.

Clark C. Everett Co., 1405, 100 Washington St.

Davis, John E., 620 Chestnut St., St. Louis.

Ericsson, Henry, Co., 84 La Salle St.

Ewen, John M., Co., The, The Rookery.

Falkenan Construction Co., 110 La Salle St.

Ferro Concrete Construction Co., The, Stock Exchange Bldg.

Gilsdorff, Henry, & Sons, 163 Randolph St.

Gindele, Chas. W., Co., 333 La Salle St.

Grace, Wm. Company, 1405 Wabash Av.

Griffiths, John & Son, 1009-1011 Merchants Loan & Trust Bldg.

Hoefer & Co., Chamber of Commerce Bldgs.

Hilger & Co., 237 Michigan Ave.

Hinschiff, Geo., Co., 188 Madison St.

Laquist & Illsey Co., 393 North Clark St.

Lederwood, A. J. C., 84 La Salle St.

Mayor, William, Co., 164 Dearborn St.

Meiling & Walther, 84 La Salle St.

Morava Construction Co., 1243 Marquette Bldg.

Mueler, Carl R., Builders' & Traders' Exchange, Box 39.

Mueler, Paul P. F., 109 Randolph St.

Nelson, F. P. & Son, 715-716 Cham. of Com.

Noel Construction Co., 198 La Salle St.

Olson Bros. Co., 6501 Peoria St.

Paschen Bros., 115 Dearborn St.

Peterson, W. F., 79 Dearborn St.

Regnill, B. J. Co., 131 La Salle St.

Rodatz, Jacob, The Rookery.

Scharmer, Jacob, 215 Dearborn St.

Shedden, James, Co., 92 La Salle St.

Snyder, J. W., Suite 1009-11, 160 Washington St.

Strandberg, E. P., Co., 108 La Salle St.

Stresenreuter Bros., 614 Chamber of Commerce.

Thompson-Stairett Co., Fisher Bldg.

Todd, James & Co., 145 La Salle St.

Warren Construction Co., The (Wm. H. Warren, Prest.), Monadnock Blk.
Wells Bros. Company, 1014 Monadnock Blk.
Wilson & Wyld, 140 Dearborn St.
Zadeck, B. M. Co., 811, 135 Adams St.

CONTRACTORS FOR STREET IMPROVEMENTS, ETC.

American Asphaltum & Rubber Co., 234 Michigan Ave.
Kettle River Quarries Co., 1033 First Nat. Bank Bldg., Chicago, Ill.

CONVEYORS—SPIRAL STEEL.

Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.
Olson Brothers, 705 Bloomingdale Av.
Webster Mfg. Co., 1075 W. 15th St.
Weller Mfg. Co., 118 East North Ave.

COPING.

Chicago Terra Cotta Co., 1208 Chamber of Commerce Bldg.
Northwestern Terra Cotta Co., The, 1415 Railway Exchange Bldg.

CORNER BEAD.

Sharon Steel Hoop Co., 115 Adams St.

CORNER BEAD METAL.

Sharon Steel Hoop Co., 115 Adams St.
Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

CORNICE MAKERS' ORNAMENTS.

Illinois Roofing & Cornice Co., 319 W. Kinzie St.
Knisely Co., Harry C., 273 S. Canal St.

CORNICE WORK.

Illinois Roofing & Cornice Co., 319 W. Kinzie St.

Knisely Bros., 28th Place and 5th Av.
Knisely Co., Harry C., 273 S. Canal St.
Krefting, E., 119 W. Van Buren St.
McFarland, J. C. Co., 27th St. & 5th Ave.
Moore-Maguire Roofing Co., 1011 Chamber of Commerce.
Staar, Frank, 615 N. Halsted St.
Sykes Steel Roofing Co., 112-120 W. 19th Pl.

CORNICES—COPPER, GALVANIZED.

Illinois Roofing & Cornice Co., 319 W. Kinzie St.
Knisely Bros., 28th Place and 5th Av.
Knisely Co., Harry C., 273 S. Canal St.
Krefting, E., 119 W. Van Buren St.
McFarland, J. C. Co., 27th St. & 5th Ave.
Staar, Frank, 615 N. Halsted St.
Sykes Steel Roofing Co., 112-120 W. 19th Pl.

CORRUGATED IRON.

Calumet Steel Co., Com'l Nat. Bank Bldg.
Knisely Bros., 28th Place and 5th Av.
McFarland, J. C. Co., 27th St. & 5th Ave.
Scully Steel & Iron Co., Halsted and Fulton.
Staar, Frank, 615 N. Halsted St.
Sykes Steel Roofing Co., 112-120 W. 19th Pl.

COTTON TWINES.

Samson Cordage Works, 115 Congress St., Boston, Mass.

CREOSOTED LUMBER, TIES, STREET BLOCKS, ETC.

Kettle River Quarries Co., 1033 First Nat. Bank Bldg., Chicago, Ill.

CRUSHED STONE DEALERS.

Knickerbocker Ice Co., 171 La Salle St.
Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

CURBING—OOLITIC LIME STONE.

Bedford Quarries Co., The, Room 638, 204 Dearborn St.

CUT STONE CONTRACTORS.

Chicago Cut Stone Co., 3403-7 La Salle St.
Kettle River Quarries Co., 1033 First Nat. Bank Bldg., Chicago, Ill.

CUTLERY AND TOOLS.

Cobb, Whyte & Laemmer Co., 45 Clark St.
Michels, N., Hardware, 1661 Lincoln Ave.
Orr & Lockett Hardware Co., 71-73 Randolph.

DAMP COURSES.

Blome, Rudolph S. Co., 79 Dearborn St.
Standard Concrete Construction Co., 184 La Salle St.

DAMP RESISTING COMPOUNDS.

Antawaka Co., The, 403 Chamber of Commerce Bldg.

Chicago Ironite Water Proofing Co., 84 La Salle St.

de Smet, Geo. W., Chamber of Commerce Bldg.

Illinois Damp Proofing Co., The, 145 La Salle St.

National Water Proof Co., 234 Michigan Ave.

Toch Bros., 320 Fifth Av.

DEADENING FELT—QUILT.

Cabot, Samuel, 28 Dearborn Ave. and Boston, Mass.

DEADENING FELTS.

Barrett Mfg. Co., 164 Dearborn St.
Cabot, Samuel, 28 Dearborn Ave. and Boston, Mass.
Union Fibre Company, 1114-15 Great Northern Bldg.

DEADENING MATERIAL.

Johns-Manville Co., H. W. (Keystone), 173 Randolph St.
Union Fibre Company, 1114-15 Great Northern Bldg.

DECORATORS.

Hasselgren, R. & Co., 440 N. State St.
Hilger & Co., 237 Michigan Ave.
McCarthy, E. J. & Co., 1704 Wabash Ave.
McCarthy, J. G., Co., 1832 Wabash Ave.
Noelle, J. B. Co., 56 Fifth Ave.
O'Brien Bros., 751 W. 43rd St.
Spierling & Linden, 1216 Michigan Av.

DECORATORS—THEATER.

Hasselgren, R. & Co., 440 N. State St.
Hilger & Co., 237 Michigan Ave.
McCarthy, E. J. & Co., 1704 Wabash Ave.
McCarthy, J. G., Co., 1832 Wabash Ave.
Noelle, J. B. Co., 56 Fifth Ave.
O'Brien Bros., 751 W. 43rd St.
Spierling & Linden, 1216 Michigan Av.

DOORS.

Chicago Veneered Door Co., 316 Chamber of Commerce Bldg.
Morgan Sash & Door Co., Blue Island Av. and Wood St.
Nollau & Wolff Mfg. Co., 1705 Fullerton
Paine Lumber Co., Chamber of Commerce.

DOORS—CROSS HORIZONTAL FOLDING.

Variety Mfg. Co., Sacramento & Carroll Avs.

DOORS—CROSS IMPROVED MEAKER.

Variety Mfg. Co., Sacramento & Carroll Avs.

DOOR HANGERS.

Wilcox Mfg. Co., Aurora, Ill.

DOORS—SLIDING SWING.

Dodge, H. B. & Co., 525, 108 La Salle St.

DOORS—VENEERED.

Chicago Veneered Door Co., 316 Chamber of Commerce Bldg.

Harty Bros. & Harty Co., W. 21st and Loomis Sts.

DRAINAGE.

Nilson Bros., 901 Belmont Ave.

Noble & Thumm, 292 Lincoln Ave.

Wills & Smith, 5338 S. Halsted St.

DRAPERS.

Hasselgren, R. & Co., 440 N. State St.
McCarthy, E. J. & Co., 1704 Wabash Ave.

DRAWING MATERIALS.

Abbott, A. H. & Co., 78 Wabash Av.
American Blue Print Paper Co., 102-104 Van Buren St. and Railway Exchange Bldg.
Dietzgen, Eugene Co., 181 Monroe St.
Keuffel & Esser Co., 111 Madison St.
United States Blue Print Paper Co., 263 La Salle St.

DRUG FIXTURES.

Brunswick-Balke-Collender Co., 263 Wabash Ave.
Chicago Bank & Office Fixture Co., 677-679 W. Van Buren St.

DRY ROOMS.

American Laundry Machinery Mfg. Co., The, 80 Franklin St.
Chicago Dryer Co., 381 Wabash Ave.
Kehm Bros. Co., 13-15 W. Kinzie St.
Troy Laundry Machinery Co., 23rd and La Salle Sts.

DYNAMOS.

Blumenthal Sons & Co., 172 Washington St.
Commonwealth-Edison Co., 139 Adams St.
Freeman-Sweet Co., 354 Dearborn St.
Kohler Bros., 1804-1812 Fisher Bldg.
McFell Electric Co., 88 W. Van Buren St.
Newgard, Henry, & Co., 30-32 W. Monroe St.
Pierce Electric Co., 237 Fifth Ave.
Slauson, W. T., & Co., 143-5 S. Clinton St.
Western Electric Co., 259 S. Clinton St.
White City Electric Co., 377 Dearborn St.

ELECTRIC BELLS AND LIGHTING.

Benjamin Electric Mfg. Co., 42 W. Jackson Blvd.
Blumenthal Sons & Co., 172 Washington St.
Commonwealth-Edison Co., 139 Adams St.
Freeman-Sweet Co., 354 Dearborn St.
Masterson Electrical Construction Co., 56 Fifth Av.
McFell Electric Co., 88 W. Van Buren St.
Newgard, Henry, & Co., 30-32 W. Monroe St.
Pierce Electric Co., 237 Fifth Ave.
Slauson, W. T., & Co., 143-5 S. Clinton St.
Tank Electric Co., 325 Dearborn St.
Wadeford Electric Co., 204 Dearborn St.
Western Electric Co., 259 S. Clinton St.
White City Electric Co., 377 Dearborn St.

ELECTRIC CONDUITS AND FITTINGS.

Western Electric Co., 259 S. Clinton St.

ELECTRIC ELEVATORS.

Altizer & Prince Co., 51 Michigan St.
Kaestner, Chas. & Co., 241-261 S. Jefferson St.
Otis Elevator Company, 9 Jackson Blvd.
Reedy, J. W. Elevator Mfg. Co., 91 Illinois St.
Western Electric Co., 259 S. Clinton St.

ELECTRIC FIXTURES.

Benjamin Electric Mfg. Co., 42 W. Jackson Blvd.
Blumenthal Sons & Co., 172 Washington St.
Freeman-Sweet Co., 354 Dearborn St.
Masterson Electrical Construction Co., 56 Fifth Av.
McFell Electric Co., 88 W. Van Buren St.
Pierce Electric Co., 237 Fifth Ave.
Slauson, W. T., & Co., 143-5 S. Clinton St.
Tank Electric Co., 325 Dearborn St.
Wadeford Electric Co., 204 Dearborn St.
Western Electric Co., 259 S. Clinton St.

ELECTRIC MOTORS.

Blumenthal Sons & Co., 172 Washington St.
Commonwealth-Edison Co., 139 Adams St.
Freeman-Sweet Co., 354 Dearborn St.
Kohler Bros., 1804-1812 Fisher Bldg.
McFell Electric Co., 88 W. Van Buren St.
Newgard, Henry, & Co., 30-32 W. Monroe St.
Pierce Electric Co., 237 Fifth Ave.
Slauson, W. T., & Co., 143-5 S. Clinton St.
Western Electric Co., 259 S. Clinton St.
White City Electric Co., 377 Dearborn St.

ELECTRIC SWITCHES.

Slauson, W. T., & Co., 143-5 S. Clinton St.
Western Electric Co., 259 S. Clinton St.

ELECTRIC SWITCHBOARDS, PANEL BOARDS.

Slauson, W. T., & Co., 143-5 S. Clinton St.

ELECTRICAL APPARATUS AND SUPPLIES.

Benjamin Electric Mfg. Co., 42 W. Jackson Blvd.

Blumenthal Sons & Co., 172 Washington St.
Commonwealth-Edison Co., 139 Adams St.
Freeman-Sweet Co., 354 Dearborn St.

Kohler Bros., 1804-1812 Fisher Bldg.
Masterson Electrical Construction Co., 56 Fifth Av.

McFell Electric Co., 88 W. Van Buren St.
Newgard, Henry, & Co., 30-32 W. Monroe St.

Pierce Electric Co., 237 Fifth Ave.
Slauson, W. T., & Co., 143-5 S. Clinton St.

Wadeford Electric Co., 204 Dearborn St.
Western Electric Co., 259 S. Clinton St.

White City Electric Co., 377 Dearborn St.

ELECTRICAL CONSTRUCTION.

Blumenthal Sons & Co., 172 Washington St.
Commonwealth-Edison Co., 139 Adams St.
Freeman-Sweet Co., 354 Dearborn St.

Kohler Bros., 1804-1812 Fisher Bldg.
Masterson Electrical Construction Co., 56 Fifth Av.

McFell Electric Co., 88 W. Van Buren St.
Newgard, Henry, & Co., 30-32 W. Monroe St.

Pierce Electric Co., 237 Fifth Ave.
Slauson, W. T., & Co., 143-5 S. Clinton St.

Tank Electric Co., 325 Dearborn St.
Wadeford Electric Co., 204 Dearborn St.

Western Electric Co., 259 S. Clinton St.
White City Electric Co., 377 Dearborn St.

ELECTRICAL FUSES.

Johns-Manville Co., H. W., 173 Randolph St.
Western Electric Co., 259 S. Clinton St.

ELECTRICAL INSULATION.

Western Electric Co., 259 S. Clinton St.

ELEVATING AND CONVEYING MACHINERY.

Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.

Olson Brothers, 705 Bloomingdale Av.

Webster Mfg. Co., 1975 W. 15th St.

Weller Mfg. Co., 118 East North Ave.

ELEVATOR CABLES.

Altizer & Prince Co., 51 Michigan St.

ELEVATOR DOORS AND ENCLOSURES.

American Bronze Foundry Co., 73rd and Woodlawn Ave.

American Iron & Wire Works, 575-581 Carroll Ave.

Brown Bros. Mfg. Co., 22d St. & Campbell Av.

Chicago Ornamental Iron Works, 37th St. and Stewart Av.

Halsted, Joseph, Co., 388 W. Randolph St.

Heath-Johnson Co., 127 E. Ontario St.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Smith, F. P. Wire & Iron Works, 100 Lake St.

Standard Company, The, Railway Exchange Union Foundry Works, First Nat'l Bank Bldg.

Vierling, McDowell & Co., 23rd St. and Stewart Av.

Voss, Frederick, 617 to 621 Austin Av.

Winslow Bros. Co., The, W. Harrison St., 46th & 47th Avs.

ELEVATOR DOORS—FREIGHT.

Harris, S. H. Co., The, 29 Pearce St.

ELEVATOR DOORS—PASSENGER.

Harris, S. H. Co., The, 29 Pearce St.

ELEVATOR ELECTRIC SIGNALS.

Elevator Supply & Repair Co., 76 W. Monroe St.

ELEVATOR FIRE DOORS.

Hanke Iron & Wire Works, 1243-47 Fillmore St.
Kinney Mfg. Co., The, 206 La Salle St.
Standard Company, The, Railway Exchange

ELEVATOR FLOOR INDICATORS.

Elevator Supply & Repair Co., 76 W. Monroe St.
Standard Company, The, Railway Exchange

ELEVATOR GATES—AUTOMATIC.

Altizer & Prince Co., 51 Michigan St.

ELEVATOR MACHINERY.

Altizer & Prince Co., 51 Michigan St.
Kaestner, Chas., & Co., 241-261 S. Jefferson St.
Otis Elevator Company, 9 Jackson Blvd.
Winslow Bros. Co., The, W. Harrison St., 46th & 47th Aves.

ELEVATOR REPAIRS.

Altizer & Prince Co., 51 Michigan St.
Elevator Supply & Repair Co., 76 W. Monroe St.
Kaestner, Chas., & Co., 241-261 S. Jefferson St.
Otis Elevator Company, 9 Jackson Blvd.
Reedy, J. W. Elevator Mfg. Co., 91 Illinois St.

ELEVATORS—PASSENGER AND

FREIGHT.

Altizer & Prince Co., 51 Michigan St.
Elevator Supply & Repair Co., 76 W. Monroe St.
Kaestner, Chas., & Co., 241-261 S. Jefferson St.
Otis Elevator Company, 9 Jackson Blvd.
Reedy, J. W. Elevator Mfg. Co., 91 Illinois St.
Winslow Bros. Co., The, W. Harrison St., 46th & 47th Aves.

ELEVATOR SAFETY GATES.

Altizer & Prince Co., 51 Michigan St.

ENGINE BEDS.

Blome, Rudolph S. Co., 79 Dearborn St.
Chicago Cut Stone Co., 3403-7 La Salle St.
Hoeffner & Co., Chamber of Commerce Bldg.
Simpson Construction Co., 704 Cham. of Com.
Standard Concrete Construction Co., 184 La Salle St.

ENGINEER AND CONTRACTOR FOR CENTRAL STATION HEATING PLANTS.

Evans, Almirall & Co., 1208 Monadnock Bldg.
Schott Engineering Co., The, Manhattan Bldg.

ENGINEERS.

Emerson, H. L., 1206 Chamber of Commerce
Hunt, Robert W. & Co., 1121 The Rookery
Shankland, E. C. & R. M., 217 La Salle St.
Worden-Allen Co., 115 Adams St.

ENGINEERS—CIVIL.

Bylesby, H. M. & Co., Continental Bank Bldg.
Emerson, H. L., 1206 Chamber of Commerce
Greeley-Howard Co., 822-112 Clark St.
Schott Engineering Co., The, Manhattan Bldg.
Shankland, E. C. & R. M., 217 La Salle St.
Westcott & Ronneberg, 1107-8, 188 Madison St.

ENGINEERS—CONSULTING.

Blumenthal Sons & Co., 172 Washington St.
Evans, Almirall & Co., 1208 Monadnock Bldg.
Freeman-Sweet Co., 354 Dearborn St.
Pierce Electric Co., 237 Fifth Ave.
Shankland, E. C. & R. M., 217 La Salle St.
Wadeford Electric Co., 204 Dearborn St.
Westcott & Ronneberg, 1107-8, 188 Madison St.

ENGINEERS—CONTRACTING.

Blumenthal Sons & Co., 172 Washington St.
Evans, Almirall & Co., 1208 Monadnock Bldg.
Freeman-Sweet Co., 354 Dearborn St.
Jennet Bridge & Iron Wks., 3541 Shields Av.

Kenwood Bridge Co., First Nat'l Bank Bldg.
Kohler Bros., 1804-1812 Fisher Bldg.
Morava Construction Co., 1243 Marquette Bldg.

Masterson Electrical Construction Co., 56 Fifth Av.

Pierce Electric Co., 237 Fifth Ave.
Strobel Steel Construction Co., 1744-1748 Monadnock Bldg.

Wadeford Electric Co., 204 Dearborn St.
Worden-Allen Co., 115 Adams St.

ENGINEERS—ELECTRICAL.

Bylesby, H. M. & Co., Continental Bank Bldg.
Evans, Almirall & Co., 1208 Monadnock Bldg.
Schott Engineering Co., The, Manhattan Bldg.

ENGINE FOUNDATIONS.

Warwick Construction Co., 324 Dearborn St.

ENGINEERS—GAS.

Bylesby, H. M. & Co., Continental Bank Bldg.
Schott Engineering Co., The, Manhattan Bldg.

ENGINEERS—IRRIGATION AND DRAINAGE.

Bylesby, H. M. & Co., Continental Bank Bldg.

ENGINEERS—MECHANICAL.

Bylesby, H. M. & Co., Continental Bank Bldg.
Evans, Almirall & Co., 1208 Monadnock Bldg.
Schott Engineering Co., The, Manhattan Bldg.

ENGINEERS—RAILWAYS.

Bylesby, H. M. & Co., Continental Bank Bldg.
Schott Engineering Co., The, Manhattan Bldg.

ENGINEERS—STRUCTURAL.

Emerson, H. L., 1206 Chamber of Commerce
Ewen, John M., Co., The, The Rookery.
Morava Construction Co., 1243 Marquette Bldg.

ENGINEERS—WATERWORKS.

Bylesby, H. M. & Co., Continental Bank Bldg.
Schott Engineering Co., The, Manhattan Bldg.

ENGINES.

Erie Mfg. & Supply Co., 1403 Fisher Bldg.
Kaestner, Chas., & Co., 241-261 S. Jefferson St.
Rider-Ericsson Engine Co., 40 Dearborn St.

ENGINES FOR ELECTRIC SERVICE.

Erie Mfg. & Supply Co., 1403 Fisher Bldg.

ENGINES—GAS.

Webster Mfg. Co., 1075 W. 15th St.

EXHAUST HEADS.

Burt Mfg. Co., 40 Dearborn St., and Akron, Ohio.

EXHAUST FANS.

Ilg Electric Ventilating Co., 221 E. Kinzie St.
Slauson, W. T., & Co., 143-5 S. Clinton St.
Variety Mfg. Co., Sacramento & Carroll Avs.
Western Electric Co., 259 S. Clinton St.

EXPANSION TANKS.

Kroeschell Bros. Co., 55 Erie St.

FACTORY SITES.

Illinois Central R. R. Co., 1 Park Row.

FEED WATER HEATERS.

Erie Mfg. & Supply Co., 1403 Fisher Bldg.
Webster, Warren & Co., 1510 Monadnock Bld.

FERRO CEMENT CONSTRUCTION.

Blome, Rudolph S. Co., 79 Dearborn St.
Ferro Concrete Construction Co., The, Stock Exchange Bldg.

Hoeffner & Co., Chamber of Commerce Bldg.
Pleas Concrete Construction Co., 503-161 Washington St.

Simpson Construction Co., 704 Cham. of Com.
Standard Concrete Construction Co., 184 La Salle St.

FILLING AND SODDING.

Newman, W. J., 50 S. Curtis St.

FILTERS.

Loomis-Manning Filter Co., 826 Land Title Bldg., Philadelphia, Pa.

FILTERS—CIL.

Burt Mfg. Co., 40 Dearborn St., and Akron, Ohio.

FILTERS—FOR RESIDENCES, HOSPITALS, HOTELS, APARTMENT AND OFFICE BUILDINGS.

Loomis-Manning Filter Co., 826 Land Title Bldg., Philadelphia, Pa.

FIRE APPARATUS.

Allen, W. D., Mfg. Co., 151 Lake St.

Ever Ready Mfg. Co., 1403 Fisher Bldg.

FIRE BRICK CONSTRUCTION.

Warwick Construction Co., 324 Dearborn St.

FIRE BRICK AND CLAY.

Garden City Sand Co., The, 134 Washington Jenkins & Reynolds Co., The, 1210 Cham. Com. Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

FIRE DOORS.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Harris, S. H. Co., The, 29 Pearce St.

Smith, F. P. Wire & Iron Works, 100 Lake St.

Variety Mfg. Co., Sacramento & Carroll Avs.

Voss, Frederick, 617 to 621 Austin Av.

Wilcox Mfg. Co., Aurora, Ill.

FIRE DOORS FOR ELEVATORS.

Harris, S. H. Co., The, 29 Pearce St.

FIRE ENGINES.

Ever Ready Mfg. Co., 1403 Fisher Bldg.

FIRE ESCAPES.

Central Iron Works of Chicago, 263-265 West Lake St.

Halsted, Joseph, Co., 388 W. Randolph St.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Muth, Chr., 428 Blue Island Av.

Smith, F. P. Wire & Iron Works, 100 Lake St.

Union Foundry Works, First Nat'l Bank Bldg.

Vierling, McDowell & Co., 23rd St. and Stewart Av.

Voss, Frederick, 617 to 621 Austin Av.

FIRE EXTINGUISHERS.

Allen, W. D., Mfg. Co., 151 Lake St.

Ever Ready Mfg. Co., 1403 Fisher Bldg.

FIRE HOSE.

Allen, W. D., Mfg. Co., 151 Lake St.

FIREPLACE FURNISHINGS, ETC.

Pickens, Edward, Co., 479 Wabash Ave.

FIREPROOF DOORS.

Dahlstrom Metallic Door Co., Monadnock Blk., and Jamestown, N. Y.

McFarland, J. C. Co., 27th St. & 5th Ave.

FIREPLACES.

Pickens, Edward, Co., 479 Wabash Ave.

FIREPROOF FLOORS.

Climax Co., 1005 Tacoma Bldg.

Illinois Terra Cotta Lumber Co., The, The Rookery.

Pleas Concrete Construction Co., 503-160 Washington St.

FIREPROOF LOCKERS.

Durand Steel Locker Co., 125 Monroe St.

FIREPROOF PAINTS.

Chicago Ironite Water Proofing Co., 84 La Salle St.

Illinois Damp Proofing Co., The, 145 La Salle St.

Muralo Co., The, 24 Market St.

Western Roofing & Supply Co., 2357 La Salle

FIREPROOF PAINTS—ANTI-FLAME.

Chicago Fire Proof Covering Co., 173 Randolph St.

FIREPROOF PARTITIONS.

Illinois Terra Cotta Lumber Co., 439 The Rookery.

National Fire Proofing Co., 115 Adams St.

Roebling Construction Co., The, Stock Exchange Bldg.

Voss, Frederick, 617 to 621 Austin Av.

FIRE PROTECTION—SPECIAL PREVENTION.

Ever Ready Mfg. Co., 1403 Fisher Bldg.

FIREPROOF SAFES.

Harris, S. H. Co., The, 29 Pearce St.

FIREPROOF SASH AND FRAMES.

Illinois Roofing & Cornice Co., 319 W. Kinzie St.

Knisely Bros., 28th Place and 5th Av.

Knisely Co., Harry C., 273 S. Canal St.

Krefting, E., 119 W. Van Buren St.

McFarland, J. C. Co., 27th St. & 5th Ave.

Rydon, E. A., & Co., 627 W. 41st St.

Staar, Frank, 615 N. Halsted St.

Sykes Steel Roofing Co., 112-120 W. 19th Pl.

Volgtman & Company, 42-54 E. Erie St.

FIREPROOF SHUTTERS AND DOORS.

Dodge, H. B. & Co., 525, 108 La Salle St.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Kinnear Mfg. Co., The, 206 La Salle St.

McFarland, J. C. Co., 27th St. & 5th Ave.

Smith, F. P. Wire & Iron Works, 100 Lake St.

Voss, Frederick, 617 to 621 Austin Av.

FIREPROOFING—SLAG.

Ill. Improvement & Ballast Co., 115 Adams St. City.

FIRE PROOF STEEL THEATRE CURTAINS.

Elevator Supply & Repair Co., 76 W. Monroe St.

FIREPROOF WINDOWS.

Illinois Roofing & Cornice Co., 319 W. Kinzie St.

Knisely Bros., 28th Place and 5th Av.

Knisely Co., Harry C., 273 S. Canal St.

Krefting, E., 119 W. Van Buren St.

McFarland, J. C. Co., 27th St. & 5th Ave.

Staar, Frank, 615 N. Halsted St.

Sykes Steel Roofing Co., 112-120 W. 19th Pl.

Volgtman & Company, 42-54 E. Erie St.

FIREPROOF WIRE LATH.

Smith, F. P. Wire & Iron Works, 100 Lake St.

Roebling Construction Co., The, Stock Exchange Bldg.

Voss, Frederick, 617 to 621 Austin Av.

FIREPROOFING.

American System of Reinforcing, 189 La Salle St.

Illinois Terra Cotta Lumber Co., 439 The Rookery.

Lock Bar Steel Concrete Co., Com'l Nat. Bk. Bldg.

National Fire Proofing Co., 115 Adams St.

Roebling Construction Co., The, Stock Exchange Bldg.

FIREPROOFING—CONCRETE.

Ferro Concrete Construction Co., The, Stock Exchange Bldg.

Pleas Concrete Construction Co., 503-160 Washington St.

FIRE WINDOWS.

Frank Staar, 615 N. Halsted St.

Illinois Roofing & Cornice Co., 319 W. Kinzie St.

Knisely Bros., 28th Place and 5th Av.

Knisely Co., Harry C., 273 S. Canal St.

Sykes Steel Roofing Co., 112-120 W. 19th Pl.

FLANGED FITTINGS.

Jenkins Bros., 226 E. Lake St.

FLOOR AND ROOF LIGHTS.

Anti-Pluvius Skylight Co., 40 Dearborn St.
Brown Bros. Mfg. Co., 22d St. & Campbell
Av.

Ritter, Emil W. Co., The, 40 Dearborn St.

FLOORS—FIRE, OIL, GASOLINE AND MOISTURE-PROOF.

Djorup, Frantz, 903 Washington Blvd.

FLOOR PLATE—WROUGHT STEEL.

Scully Steel & Iron Co., Halsted and Fulton
Sts.

FLOORS—SANITARY.

Djorup, Frantz, 903 Washington Blvd.

FLOORS—SOLID WITHOUT CRACKS.

Djorup, Frantz, 903 Washington Blvd.

FLOORING.

Hines, Edw., Lumber Co., 1124 S. Lincoln St.

FLOORING—HARDWOOD.

Burns, John E., Lumber Co., 40 W. Chicago
Av.

Rittenhouse & Embree Co., 3500 Center Av.

Wilce, T. Co., The, 22nd and Throop Sts.

FLOORING—WOOD BLOCK.

Dodge, H. B. & Co., 525, 108 La Salle St.

FLUE LININGS.

Garden City Sand Co., The, 134 Washington
Hydraulic Press Brick Co., 3rd Floor Cham-
ber of Commerce Bldg.

FORGINGS.

Jackson, George W., Inc., 169-179 W. Jack-
son Blvd.

Jennet Bridge & Iron Wks., 3541 Shields Av.
Kenwood Bridge Co., First Nat'l Bank Bldg.
Worden-Alten Co., 115 Adams St.

FOUNDATIONS—CONCRETE.

Hoeffer & Co., Chamber of Commerce Bldg.
National Water Proof Co., 234 Michigan
Ave.

Pleas Concrete Construction Co., 503-160
Washington St.

Raymond Concrete Pile Co., 135 Adams St.
Warwick Construction Co., 324 Dearborn St.
Westcott & Ronneberg, 1107-8, 188 Madison
St.

FOUNDERS.

Butler St. Foundry & Iron Co., 3422 Butler
St.

Illinois Malleable Iron Co., 537 Diversey
Bldv.

Jeffrey Mfg. Co., Monadnock Bldg., and Colum-
bus, Ohio.

Webster Mfg. Co., 1075 W. 15th St.

FRAMES—WINDOW.

Morgan Sash & Door Co., Blue Island Av.
and Wood St.

Peterson, C. E. Co., 1914-22 Wentworth Ave.

FRAMES—WINDOW AND DOOR.

Nollau & Wolff Mfg. Co., 1705 Fullerton
Palne Lumber Co., Chamber of Commerce.
Peterson, C. E. Co., 4914-22 Wentworth Av.

FRICITION CLUTCHES.

Jeffrey Mfg. Co., Monadnock Bldg., and Colum-
bus, Ohio.

Kaestner, Chas. & Co., 241-261 S. Jefferson St.

Olson Brothers, 705 Bloomingdale Av.

Peterson, C. E. Co., 4914-22 Wentworth Ave.

Webster Mfg. Co., 1075 W. 15th St.

Weller Mfg. Co., 118 East North Ave.

FURNACES.

Lewis & Kitchen, 1200 Michigan Av.

McMaster-Carr Supply Co., 174 Lake St.
Mueller, L. J., Furnace Co., 40 Dearborn St.,
and Milwaukee, Wis.

Richardson & Boynton Co., 20 Lake St.

Ritter, Emil W. Co., The, 40 Dearborn St.

Robinson Furnace Co., 107-109 Lake St.

FURNACE BUILDERS—BRICK.

Warwick Construction Co., 324 Dearborn St.

FURNACES—TUBULAR.

Robinson Furnace Co., 107-109 Lake St.

GALVANIZED AND BLACK SHEETS.

Calumet Steel Co., Com'l Nat. Bank Bldg.
Scully Steel & Iron Co., Halsted & Fulton.

GALVANIZED IRON.

Calumet Steel Co., Com'l Nat. Bank Bldg.

Knibbly Bros., 28th Place and 5th Av.

Krefting, E., 119 W. Van Buren St.

Scully Steel & Iron Co., Halsted & Fulton.

Staar, Frank, 615 N. Halsted St.

Sykes Steel Roofing Co., 112-120 W. 19th Pl.

GARBAGE CREMATORIES.

Dube, John J., 401-56 Fifth Ave.

GAS FITTING.

Farwell, B. J., 42 Sherman St.

Nilson Bros., 901 Belmont Ave.

Noble & Thumm, 292 Lincoln Av.

Wills & Smith, 5938 S. Halsted St.

GAS—ILLUMINATING.

People's Gas Light & Coke Co., Michigan Av.
and Adams St.

GAS LOGS.

Pickens, Edward, Co., 479 Wabash Ave.

GAS MACHINES.

Johnson Service Co., 93 Lake St.

GAS—NATURAL.

People's Gas Light & Coke Co., Michigan Av.
and Adams St.

GAUGES—STEAM.

McMaster-Carr Supply Co., 174 Lake St.

GENERAL CONTRACTORS.

Alling Construction Co., 72 Madison St.

Anderson A. & E., 512 Tacoma Bldg.

Bent, E. M. Co., 506 Security Bldg.

Sulley & Andrews, 411, 115 Dearborn St.

Cadenhead & Morow Co., 79 Dearborn St.

Chapman, Chas., 84 La Salle St.

Clark C. Everett Co., 1405, 100 Washington St.

Davis, John E., 620 Chestnut St., St. Louis.

Ericsson, Henry, Co., 84 La Salle St.

Ewen, John M., Co., The, The Rookery.

Falkenau Construction Co., 110 La Salle St.

Ferro Concrete Construction Co., The, Stock
Exchange Bldg.

Gilsdorff, Henry, & Sons, 163 Randolph St.

Glendale, Chas. W., Co., 3333 La Salle St.

Grace, Wm. Company, 1408 Wabash Av.

Griffiths, John & Son, 1009-1011 Merchants
Loan & Trust Bldg.

Hinschiff, Geo., Co., 188 Madison St.

Langquist & Ilsley Co., 393 North Clark St.

Ledgerwood, A. J. C., 84 La Salle St.

Mavor, William Co., 164 Dearborn St.

Melling & Walther, 84 La Salle St.

Morava Construction Co., 1243 Marquette.

Mueller, Carl R., Builders' & Traders' Ex-
change, Box 39.

Mueller, Paul P. F., 109 Randolph St.

Nelson, F. P., & Son, 715-716 Cham. of Com.

Noel Construction Co., 108 La Salle St.

Olson Bros. Co., 6501 Peoria St.

Paschen Bros., 115 Dearborn St.

Peterson, W. F., 79 Dearborn St.

Regnell, B. J. Co., 131 La Salle St.

Rodatz, Jacob, The Rookery.

Scharmer, Jacob, 215 Dearborn St.

Shedden, James, Co., 92 La Salle St.

Snyder, J. W., Suite 1009-11, 160 Wash-
ington St.

Strandberg, E. P., Co., 108 La Salle St.

Stresenreuter Bros., 614 Chamber of Commerce.

Thompson-Starrett Co., Fisher Bldg.

Todd, James & Co., 145 La Salle St.

Warren Construction Co., The (Wm. H.

Warren, Prest.), Monadnock Bld.

Warwick Construction Co., 324 Dearborn St.

Wells Bros. Company, 1014 Monadnock Bld.

Wilson & Wyld, 140 Dearborn St.

Zadeck, B. M. Co., 811, 135 Adams St.

GLASS.

American Luxfer Prism Co., Heyworth Bldg.

GLASS—ART, ORNAMENTAL AND STAINED.

American Luxfer Prism Co., Heyworth Bldg.
Giannini & Hilgart, 211 E. Madison St.
Linden Glass Co., 1216 Michigan Av.
Schuler Art Glass Co., Madison and Canal.
Spierling & Linden, 1216 Michigan Av.

GLASS—CUT.

Giannini & Hilgart, 211 E. Madison St.
Schuler Art Glass Co., Madison and Canal.

GLASS—BEVELED.

American Luxfer Prism Co., Heyworth Bldg.
Giannini & Hilgart, 211 E. Madison St.
Schuler Art Glass Co., Madison and Canal.

GLASS—MOASIC.

Giannini & Hilgart, 211 E. Madison St.
Linden Glass Co., 1216 Michigan Av.
Schuler Art Glass Co., Madison and Canal.

GLASS—PRISMATIC.

American Luxfer Prism Co., Heyworth Bldg.

GLASS—WIRE.

Mississippi Wire & Glass Co., 72 Madison St.

GRAIN ELEVATOR MACHINERY.

Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.
Kaestner, Chas. & Co., 241-261 S. Jefferson St.
Olson Brothers, 705 Bloomingdale Av.
Webster Mfg. Co., 1075 W. 15th St.
Weller Mfg. Co., 118 East North Ave.

GRANITE.

Chicago Cut Stone Co., 3403-7 La Salle St.
Woodbury Granite Co., 98 Jackson Blvd.

GRANITE FOR BUILDING PURPOSES.

Woodbury Granite Co., 98 Jackson Blvd.

GRATES FOR FIREPLACES.

Pickens, Edward, Co., 479 Wabash Ave.

GRAVEL.

American Sand & Gravel Co., 907 Cham. of Com. Bldg.
Knickerbocker Ice Co., 171 La Salle St.

GRILLE WORK.

Architectural Decorating Co., 643 S. Jefferson.
Chicago Ornamental Iron Works, 37th St. and Stewart Av.

GRILLE WORK—METAL.

American Bronze Foundry Co., 73rd and Woodlawn Ave.
Brown Bros. Mfg. Co., 22d St. & Campbell Av.
Heath-Johnson Co., 127 E. Ontario St.
Hanke Iron & Wire Works, 1243-47 Fillmore St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Standard Company, The, Railway Exchange

GRILLES.

Builders & Decorators Supply Co., 152 Veder St.

Decorators' Supply Co., The, Archer Av. & Leo St.

Plastic Relief Mfg. Co., The, 298 N. Halsted St.

HAIR FELT.

Barrett Mfg. Co., 164 Dearborn St.
Chicago Fire Proof Covering Co., 173 Randolph St.
Johns-Manville Co., H. W., 173 Randolph St.
Western Roofing & Supply Co., 2357 La Salle

HANGERS AND SHAFTING.

Scully Steel & Iron Co., Halsted and Fulton Sts.

HANGER SUPPORTS FOR REINFORCED CONCRETE CONSTRUCTION.

Kass-Hall Mfg. Co., The, 4515 Evans Av.

HARDWARE.

Cobb, Whyte & Laemmer Co., 45 Clark St.
Michels, N., Hardware, 1661 Lincoln Ave.
Orr & Lockett Hardware Co., 71-73 Randolph.

HARDWARE—BUILDERS'.

Cobb, Whyte & Laemmer Co., 45 Clark St.
Michels, N., Hardware, 1661 Lincoln Ave.
Orr & Lockett Hardware Co., 71-73 Randolph.

HARDWARE—MANUFACTURERS'.

Reading Hardware Co., 105 Lake St.

HARDWARE SPECIALTIES.

Cobb, Whyte & Laemmer Co., 45 Clark St.
Michels, N., Hardware, 1661 Lincoln Ave.
Reading Hardware Co., 105 Lake St.
Ritter, Emil W. Co., The, 40 Dearborn St.

HARDWOOD FLOORING.

Bader-Peterson & Co., 21 E. North Ave.
Burns, John E., Lumber Co., 40 W. Chicago Av.

Hines, Edw., Lumber Co., 1124 S. Lincoln St.
North Side Lumber & Timber Co., Lincoln Av. and Grace St.
Rittenhouse & Embree Co., 3500 Center Av.
Wilce, T. Co., The, 22nd and Throop Sts.

HARDWOOD FLOORING—MANUFACTURERS'.

Wilce, T. Co., The, 22nd and Throop Sts.

HARDWOOD LUMBER.

Bader-Peterson & Co., 21 E. North Ave.
Burns, John E., Lumber Co., 40 W. Chicago Av.

Hines, Edw., Lumber Co., 1124 S. Lincoln St.
North Side Lumber & Timber Co., Lincoln Av. and Grace St.
Rittenhouse & Embree Co., 3500 Center Av.
Wilce, T. Co., The, 22nd and Throop Sts.

HEAT REGULATION.

Johnson Service Co., 93 Lake St.
Powers Regulator Co., The, 40 Dearborn St.

HEATING APPARATUS.

Deppmann, A. & Co., 212 Illinois St.
Deppmann, L., 1559 Lincoln Ave.
Dilzer Fred, 48 Dearborn St.
Dube, John J., 401-56 Fifth Ave.
Glennon, Charles & Co., 30 La Salle St.
Graves, W. B., Co., 121 Kinzie St.
Hanley-Casey Co., 37 Ohio St.
Illinois Malleable Iron Co., 537 Diversey Blvd.

Kewanee Boiler Co., 35 Michigan Av.
Kilander, A. & Co., 141 S. Clinton St.
Kroeschell Bros. Co., 55 Erie St.
Lees, William, 97 S. Clinton St.
Lewis & Kitchen, 1200 Michigan Av.
McMaster-Carr Supply Co., 174 Lake St.
Mohr, John & Sons, 32 Illinois St.
Mueller, L. J., Furnace Co., 40 Dearborn St., and Milwaukee, Wis.
Narowetz, Louis, 13-15 W. Kinzie St.
Nilson Bros., 901 Belmont Ave.
Norton, F. J., 8 North State St.
Phillips-Getschow Co., 181 Indiana St.
Pope, William A., 80 Lake St.
Purves Heating Co., 215 Fifth Av.
Richardson & Boynton Co., 20 Lake St.
Thomas & Smith, 17-19 S. Carpenter St.
Union Iron Works, 1402 Fisher Bldg.
Wills & Smith, 5938 S. Halsted St.

HEATING SUPPLIES.

Davis, G. M., Regulator Co., 114-116 Milwaukee Av.
Glennon, Charles & Co., 30 La Salle St.
Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.
Illinois Malleable Iron Co., 537 Diversey Blvd.
Kehm Bros. Co., 13-15 W. Kinzie St.

Kewance Boiler Co., 35 Michigan Av.
Kroeschell Bros. Co., 55 Erie St.
Mueller, L. J., Furnace Co., 40 Dearborn St.,
and Milwaukee, Wis.
Phillips-Getschow Co., 184 Indiana St.
Webster, Warren & Co., 1510 Monadnock Blk.

HEATING—VACUUM.

Webster, Warren & Co., 1510 Monadnock Blk.

HEATING AND VENTILATING.

Arcade Steam Heating Co., 153 Kinzie St.
Deppmann, A. & Co., 212 Illinois St.
Deppmann, L., 1599 Lincoln Ave.
Dilzer, Fred, 48 Dearborn St.
Evans, Almirall & Co., 1208 Monadnock Bldg
Farwell, B. J., 42 Sherman St.
Glenmon, Charles & Co., 30 La Salle St.
Graves, W. B., Co., 121 Kinzie St.
Hanley-Casey Co., 37 Ohio St.
Ideal Heating Co., 6312 Wentworth Av.
Itg Electric Ventilating Co., 221 E. Kinzie St.
Kilander, A. & Co., 141 S. Clinton St.
Kirk, Geo. H., 6612 Wentworth Av.
Kroeschell Bros. Co., 55 Erie St.
Lees, William, 97 S. Clinton St.
Lewis & Kitchen, 1200 Michigan Av.
Mueller, L. J., Furnace Co., 40 Dearborn St.,
and Milwaukee, Wis.
Narowetz, Louis, 13-15 W. Kinzie St.
Nilson Bros., 301 Belmont Ave.
Norton, F. J., 8 North State St.
Phillips-Getschow Co., 184 Indiana St.
Pope, William A., 80 Lake St.
Prentice, L. H. Co., 24-26 Sherman St.
Purves Heating Co., 215 Fifth Av.
Thomas & Smith, 17-19 S. Carpenter St.
Wills & Smith, 5938 S. Halsted St.

HEATING AND VENTILATING—ENGINEERS.

Evans, Almirall & Co., 1208 Monadnock Bldg.

HEATERS—WARM AIR AND COMBINATION.

Robinson Furnace Co., 107-109 Lake St.

HEAVY FOUNDATIONS.

Jackson, George W., Inc., 169-179 W. Jackson Blvd.
Warwick Construction Co., 324 Dearborn St.

HEAVY PLATE WORK.

Mohr, John & Sons, 32 Illinois St.

HECTOGRAPH PRINTS.

American Blue Print Paper Co., 102-104 Van Buren St. and Railway Exchange Bldg.
Crofoot, Nielsen & Co., 167 E. Washington St.
United States Blue Print Paper Co., 263 La Salle St.

HOISTS—AIR AND CHAIN.

Scully Steel & Iron Co., Halsted and Fulton Sts.

HOISTING AND CONVEYING MACHINERY.

Jeffrey Mfg. Co., Monadnock Bldg. and Columbus, Ohio.
Olson Brothers, 707 Bloomingdale Av.
Webster Mfg. Co., 1075 W. 15th St.
Weller Mfg. Co., 118 East North Ave.

HOLLOW STEEL DOORS.

Dahlstrom Metallic Door Co., Monadnock Blk., and Jamestown, N. Y.

HORIZONTAL FOLDING DOORS.

Harris, S. H. Co., The, 29 Pearce St.

HOSE, RACKS AND REELS.

Allen, W. D., Mfg. Co., 151 Lake St.

HOT AIR PUMPS.

Rider-Ericsson Engine Co., 40 Dearborn St.

HOT BLAST HEATING APPARATUS.

Arcade Steam Heating Co., 153 Kinzie St.
Davis, G. M., Regulator Co., 114-116 Milwaukee Av.
Deppmann, A. & Co., 212 Illinois St.

Deppmann, L., 1599 Lincoln Ave.
Kehm Bros. Co., 13-15 W. Kinzie St.
Kilander, A. & Co., 141 S. Clinton St.
Narowetz, Louis, 13-15 W. Kinzie St.
Phillips-Getschow Co., 184 Indiana St.
Prentice, L. H. Co., 24-26 Sherman St.

HOT WATER HEATERS.

Arcade Steam Heating Co., 153 Kinzie St.
Davis Construction Co., 41 Dearborn St.
Deppmann, L., 1599 Lincoln Ave.
Dilzer, Fred, 48 Dearborn St.
Dube, John J., 401-56 Fifth Ave.
Glenmon, Charles & Co., 30 La Salle St.
Hanley-Casey Co., 37 Ohio St.
Illinois Malleable Iron Co., 537 Diversey Blvd.
Kewanee Boiler Co., 35 Michigan Av.
Kilander, A. & Co., 141 S. Clinton St.
Kroeschell Bros. Co., 55 Erie St.
Lewis & Kitchen, 1200 Michigan Av.
Mueller, L. J., Furnace Co., 40 Dearborn St.,
and Milwaukee, Wis.
Phillips-Getschow Co., 184 Indiana St.
Purves Heating Co., 215 Fifth Av.
Richardson & Boynton Co., 20 Lake St.
Thomas & Smith, 17-19 S. Carpenter St.
Wills & Smith, 5938 S. Halsted St.

HOT WATER AND STEAM HEATING.

Arcade Steam Heating Co., 153 Kinzie St.
Deppmann, A. & Co., 212 Illinois St.
Deppmann, L., 1599 Lincoln Ave.
Dilzer, Fred, 48 Dearborn St.
Evans, Almirall & Co., 1208 Monadnock Bldg
Farwell, B. J., 42 Sherman St.
Glenmon, Charles & Co., 30 La Salle St.
Graves, W. B., Co., 121 Kinzie St.
Hanley-Casey Co., 37 Ohio St.
Ideal Heating Co., 6312 Wentworth Av.
Kehm Bros. Co., 13-15 W. Kinzie St.
Kilander, A. & Co., 141 S. Clinton St.
Kirk, Geo. H., 6612 Wentworth Av.
Kroeschell Bros. Co., 55 Erie St.
Lees, William, 97 S. Clinton St.
Lewis & Kitchen, 1200 Michigan Av.
Mueller, L. J., Furnace Co., 40 Dearborn St.,
and Milwaukee, Wis.
Nacey, P. Co., 315-317 Wabash Av.
Narowetz, Louis, 13-15 W. Kinzie St.
Nilson Bros., 301 Belmont Ave.
Noble & Thumm, 292 Lincoln Av.
Norton, F. J., 8 North State St.
Phillips-Getschow Co., 184 Indiana St.
Pope, William A., 80 Lake St.
Prentice, L. H. Co., 24-26 Sherman St.
Purves Heating Co., 215 Fifth Av.
Thomas & Smith, 17-19 S. Carpenter St.
Wills & Smith, 5938 S. Halsted St.

HOUSE MOVERS AND RAISERS.

Friestedt, L. P., Co., 1526-28 Tribune Bldg
Riedeau, L. J., & Son, 928 Stock Ex. Bldg.
Sheeler, H. Co., 716 Chamber of Commerce

HYDRAULIC ELEVATORS.

Altizer & Prince Co., 51 Michigan St.
Otis Elevator Company, 9 Jackson Blvd.
Reedy, J. W. Elevator Mfg. Co., 91 Illinois St.

HYDRANTS.

Jenkins Bros., 226 E. Lake St.

HYGIENIC KALSOMINE.

Adams & Elting Co., 155 W. Washington St.
ICE FACTORY AND REFRIGERATING PLANT SUPPLIES.

Creamery Package Mfg. Co., The, 184 Kinzie St.

Wolf, Fred W. Co., The, 139 Rees St.

York Mfg. Co., 1060 Monadnock Block.

ICE MAKING MACHINERY.

Creamery Package Mfg. Co., The, 184 Kinzie St.

Wolf, Fred W. Co., The, 139 Rees St.

ICE MAKING AND REFRIGERATING MACHINERY.

Creamery Package Mfg. Co., The, 184 Kinzie St.

Wolf, Fred W. Co., The, 139 Rees St.

York Mfg. Co., 1060 Monadnock Block

INDUCED DRAFT REGULATORS.

Davis, G. M., Regulator Co., 144-146 Milwaukee Av.
Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

INSPECTORS.

Hunt, Robert W. & Co., 1121 The Rookery.

INSULATING PAPERS.

Barrett Mfg. Co., 164 Dearborn St.
Johns-Manville Co., H. W., 173 Randolph St.
Union Fibre Company, 1114-15 Great Northern Bldg.

Western Roofing & Supply Co., 2357 La Salle

INSULATION—BREWERIES AND COLD STORAGE WAREHOUSES.

Illinois Terra Cotta Lumber Co., 439 The Rookery.
National Fire Proofing Co., 115 Adams St.
Union Fibre Company, 1114-15 Great Northern Bldg.

INSURANCE.

Marsh & McLennan, 159 La Salle St.

INSURANCE (IN ALL ITS BRANCHES).

Marsh & McLennan, 159 La Salle St.

INTERIOR DECORATORS.

Architectural Decorating Co., 643 S. Jefferson.
Hasselgren, R. & Co., 440 N. State St.
Hilger & Co., 237 Michigan Ave.
McCarthy, E. J. & Co., 1704 Wabash Ave.
McCarthy, J. G. Co., 1832 Wabash Ave.
Noelle, J. B. Co., 54 Fifth Ave.
O'Brien Bros., 751 W. 43rd St.
Splerling & Linden, 1216 Michigan Av.

INTERIOR FINISH.

Baumann F. O. Mfg. Co., Blackhawk St. and Smith Ave.
Chicago Sash, Door & Blind Mfg. Co., 48 W. North Av.
Chicago Veneered Door Co., 316 Chamber of Commerce Bldg.
Harty Bros. & Harty Co., W. 21st and Loomis Sts.
Mears, Slayton Lumber Co., 1103 Belmont Ave.
Nollau & Wolff Mfg. Co., 1705 Fullerton
Peterson, C. E. Co., 4914-22 Wentworth Ave.
Schweizer & West Mfg. Co., 56-94 North Ada St.

INTERIOR MOLDINGS.

Nollau & Wolff Mfg. Co., 1705 Fullerton

INTERLOCKING RUBBER TILE.

New York Belting & Packing Co., Ltd., 150 Lake St.

IRON, COMMON—NORWAY.

Scully Steel & Iron Co., Halsted and Fulton Sts.

IRON DOORS AND SHUTTERS.

Butler St. Foundry & Iron Co., 3422 Butler St.

Central Iron Works of Chicago, 263-265 West Lake St.

Dahlstrom Metallic Door Co., Monadnock Blk. and Jamestown, N. Y.

Halsted, Joseph, Co., 388 W. Randolph St.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Harris, S. H. Co., The, 29 Pearce St.

Kinnear Mfg. Co., The, 206 La Salle St.

Muth, Chr., 428 Blue Island Av.

Ritter, Emil W. Co., The, 40 Dearborn St.

Smith, F. P. Wire & Iron Works, 100 Lake St.

Vierling, McDowell & Co., 23rd St. and Stewart Av.

Voss, Frederick, 617 to 621 Austin Av.

IRON FOUNDRIES.

Butler St. Foundry & Iron Co., 3422 Butler St.

Reder Foundry Co., Canalport Av., Sangamon & Johnson Sts.

IRON RAILINGS AND FENCES.

American Bronze Foundry Co., 73rd and Woodlawn Ave.

American Iron & Wire Works, 575-581 Carroll Ave.

Anderson, A. F., 5836 Loomis St.

Brown Bros. Mfg. Co., 22d St. & Campbell Av.

Butler St. Foundry & Iron Co., 3422 Butler St.

Chicago Ornamental Iron Works, 37th St. and Stewart Av.

Halsted, Joseph, Co., 388 W. Randolph St.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Holmes, Fyott & Co., 13 N. Jefferson St.

Muth, Chr., 428 Blue Island Av.

Smith, F. P. Wire & Iron Works, 100 Lake St.

South Halsted St. Iron Works, 135 Adams St.

Standard Company, The, Railway Exchange

Union Foundry Works, First Nat'l Bank Bldg.

Vierling, McDowell & Co., 23rd St. and Stewart Av.

Voss, Frederick, 617 to 621 Austin Av.

IRON ROOFS.

Jennet Bridge & Iron Wks., 3541 Shields Av.

Kenwood Bridge Co., First Nat'l Bank Bldg.

Moraya Construction Co., 1243 Marquette

Muth, Chr., 428 Blue Island Av.

Scully Steel & Iron Co., Halsted and Fulton Sts.

Strobel Steel Construction Co., 1744-1748

Monadnock Blk.

Sykes Steel Roofing Co., 112-120 W. 19th Pl.

IRON STAIRS.

American Iron & Wire Works, 575-581

Carroll Ave.

Butler St. Foundry & Iron Co., 3422 Butler St.

Central Iron Works of Chicago, 263-265 West

Lake St.

Chicago Ornamental Iron Works, 37th St. and

Stewart Av.

Halsted, Joseph Co., 388 W. Randolph St.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Muth, Chr., 428 Blue Island Av.

Scully Steel & Iron Co., Halsted and Fulton Sts.

Smith, F. P. Wire & Iron Works, 100 Lake St.

Standard Company, The, Railway Exchange

Vierling, McDowell & Co., 23rd St. and

Stewart Av.

Voss, Frederick, 617 to 621 Austin Av.

Winslow Bros. Co., The, W. Harrison St.,

46th & 47th Avs.

IRON STORE FRONTS.

American Iron & Wire Works, 575-581

Carroll Ave.

Anderson, A. F., 5836 Loomis St.

Butler St. Foundry & Iron Co., 3422 Butler

St.

Central Iron Works of Chicago, 263-265 West

Lake St.

Chicago Ornamental Iron Works, 37th St. and

Stewart Av.

Halsted, Joseph, Co., 388 W. Randolph St.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Heath-Johnson Co., 127 E. Ontario St.

Muth, Chr., 428 Blue Island Av.

Scully Steel & Iron Co., Halsted and Fulton Sts.

Smith, F. P. Wire & Iron Works, 100 Lake St.

Standard Company, The, Railway Exchange

Vierling, McDowell & Co., 23rd St. and

Stewart Av.

Voss, Frederick, 617 to 621 Austin Av.

Winslow Bros. Co., The, W. Harrison St.,

46th & 47th Avs.

IRON WORK—ORNAMENTAL.

American Iron & Wire Works, 575-581

Carroll Ave.

Anderson, A. F., 5836 Loomis St.

Brown Bros. Mfg. Co., 22d St. & Campbell

Av.

Butler St. Foundry & Iron Co., 3422 Butler

St.

Central Iron Works of Chicago, 263-265 West Lake St.
Chicago Ornamental Iron Works, 37th St. and Stewart Av.
Halsted, Joseph Co., 388 W. Randolph St.
Hanke Iron & Wire Works, 1243-47 Fillmore St.
Heath-Johnson Co., 127 E. Ontario St.
Holmes, Pyott & Co., 13 N. Jefferson St.
Muth, Chr., 428 Blue Island Av.
Smith, F. P. Wire & Iron Works, 100 Lake St.
South Halsted St. Iron Works, 135 Adams St.
Standard Company, The, Railway Exchange Union Foundry Works, First Nat'l Bank Bldg.
Vierling, McDowell & Co., 23rd St. and Stewart Av.
Voss, Frederick, 617 to 621 Austin Av.
Winslow Bros. Co., The, W. Harrison St., 46th & 47th Avs.

IRON WORK—STRUCTURAL.

Anderson, A. F., 5836 Loomis St.
Butler St. Foundry & Iron Co., 3422 Butler St.
Jenner Bridge & Iron Wks., 3541 Shields Av.
Kenwood Bridge Co., First Nat'l Bank Bldg.
Morava Construction Co., 1243 Marquette.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Strobel Steel Construction Co., 1744-1748 Monadnock Bldg.
Voss, Frederick, 617 to 621 Austin Av.

JAIL AND PRISON BUILDERS.

Anderson, A. F., 5836 Loomis St.
Butler St. Foundry & Iron Co., 3422 Butler St.
Halsted, Joseph Co., 388 W. Randolph St.
Holmes, Pyott & Co., 13 N. Jefferson St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
South Halsted St. Iron Works, 135 Adams St.
Union Foundry Works, First Nat'l Bank Bldg.
Vierling, McDowell & Co., 23rd St. and Stewart Av.
Voss, Frederick, 617 to 621 Austin Av.

KALSOMINE.

Adams & Elting Co., 155 W. Washington St.
Heath & Milligan Mfg. Co., 172 Randolph Moore, Benjamin & Co., 111-117 N. Green St.
Muralo Co., The, 24 Market St.

LAMPS EXTERIOR—IRON AND BRONZE
American Bronze Foundry Co., 73rd and Woodlawn Ave.
Brown Bros. Mfg. Co., 22nd St. and Campbell Av.
Chicago Ornamental Iron Works, 37th St. and Stewart Ave.
Standard Company, The, Railway Exchange

LATH.

Burns, John E., Lumber Co., 40 W. Chicago Av.

LATH—METAL AND WIRE.

Roebling Construction Co., The, Stock Exchange Bldg.
Voss, Frederick, 617 to 621 Austin Av.
Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

LAUNDRY DRYERS.

American Laundry Machinery Mfg. Co., The, 80 Franklin St.
Chicago Dryer Co., 381 Wabash Ave.
Troy Laundry Machinery Co., 23rd and La Salle Sts.

LAUNDRY MACHINERY.

American Laundry Machinery Mfg. Co., The, 80 Franklin St.
Chicago Dryer Co., 381 Wabash Ave.
Judd Oscillating Cleaner Co., 420-471 La Salle St.
Troy Laundry Machinery Co., 23rd and La Salle Sts.

LAUNDRY MACHINERY SUPPLIES.

American Laundry Machinery Mfg. Co., The, 80 Franklin St.

Judd Oscillating Cleaner Co., 420-471 La Salle St.
Troy Laundry Machinery Co., 23rd and La Salle Sts.

LAUNDRY TRAYS AND KITCHEN SINKS.

Alberene Stone Co., 56 N. Clinton St.

LEATHER BELTING.

Allen, W. D., Mfg. Co., 151 Lake St.

LIABILITY INSURANCE.

Marsh & McLennan, 159 La Salle St.

LIME.

Meacham & Wright Co., 805-10 Corn Ex. Bank Bldg.

Knickerbocker Ice Co., 171 La Salle St.

Schultz, F., 16th and Ruble Sts.
Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

LINK BELTING.

Jeffrey Mfg. Co., Monadnock Bldg., and Columbus Av.

Webster Mfg. Co., 1075 W. 15th St.

LOANS.

Bald & Warner, 90 La Salle St.

Greenebaum Sons, 59 Clark St.

LOCATIONS FOR IRON AND STEEL PLANTS.

Illinois Central R. R. Co., 1 Park Row.

LOCKERS—SHEET STEEL.

Durand Steel Locker Co., 125 Monroe St.

LOCKERS—VENTILATED.

Dodge, H. B. & Co., 525-108 La Salle St.

LUMBER.

Bader-Peterson & Co., 21 E. North Ave.

Burns, John E., Lumber Co., 40 W. Chicago Av.

Hines, Edw., Lumber Co., 1124 S. Lincoln St.
Mears, Slayton Lumber Co., 1103 Belmont Ave.

North Side Lumber & Timber Co., Lincoln Av. and Grace St.

Paline Lumber Co., Chamber of Commerce.

Pilsen Lumber Co., The, Laflin & 22d St.

Rittenhouse & Embree Co., 3500 Center Av.

Wilce, T. Co., The, 22nd and Throop Sts.

LUMBER—KILN DRIED.

Bader-Peterson & Co., 21 E. North Ave.
Burns, John E., Lumber Co., 40 W. Chicago Av.

Hines, Edw., Lumber Co., 1124 S. Lincoln St.
North Side Lumber & Timber Co., Lincoln Av. and Grace St.

Pilsen Lumber Co., The, Laflin & 22d St.

Rittenhouse & Embree Co., 3500 Center Av.

Wilce, T. Co., The, 22nd and Throop Sts.

LUMBER—YELLOW PINE—LONG LEAF.

Bader-Peterson & Co., 21 E. North Ave.
Burns, John E., Lumber Co., 40 W. Chicago Av.

Hines, Edw., Lumber Co., 1124 S. Lincoln St.
North Side Lumber & Timber Co., Lincoln Av. and Grace St.

Pilsen Lumber Co., The, Laflin and 22d St.

MACADAM—SLAG.

Ill. Improvement & Ballast Co., 115 Adams St. City.

MACHINISTS.

Creamery Package Mfg. Co., The, 184 Kinzie St.

Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

Jackson, George W., Inc., 169-179 W. Jackson Blvd.

Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.

Kaestner, Chas. & Co., 241-261 S. Jefferson St.

Olson Brothers, 705 Bloomingdale Av.

Webster Mfg. Co., 1075 W. 15th St.
Weller Mfg. Co., 118 East North Ave.
Wolf, Fred W. Co., The, 139 Rees St.
Worden-Allen Co., 115 Adams St.
York Mfg. Co., 1060 Monadnock Block.

MACHINERY FOR RAILROAD REPAIRS, STRUCTURAL AND BRIDGE SHOPS.

Scully Steel & Iron Co., Halsted and Fulton Sts.

MAIL CHUTES.

Cutler Mail Chute Co., Chamber of Commerce Bldg., and Rochester, N. Y.

MANTELS.

Pickens, Edward, Co., 479 Wabash Ave.

MANTELS—WOOD, BRICK AND TILE.

Pickens, Edward, Co., 479 Wabash Ave.

MARBLE WORKERS AND DEALERS.

Art Marble Co., Flournoy and Rockwell Sts.
Caretti, John & Co., 53 Michigan St.

Marthens, Chester N., Marble Co., 53d and Wallace Sts.

Pickens, Edward, Co., 479 Wabash Ave.
Sherman-Flavin Marble Co., 2505-2509 State St.

MASON CONTRACTORS.

Alling Construction Co., 72 Madison St.
Anderson A. & E., 512 Tacoma Bldg.

Bent, E. M. Co., 506 Security Bldg.
Bulley & Andrews, 411, 115 Dearborn St.

Cadenhead & Morow Co., 79 Dearborn St.
Chapman, Chas., 84 La Salle St.

Clark C. Everett Co., 1405, 100 Washington St.
Davis, John E., 620 Chestnut St., St. Louis.

Ericsson, Henry, Co., 84 La Salle St.
Ewen, John M., Co., The, The Rookery.

Gilsdorff, Henry, & Sons, 163 Randolph St.
Gindele, Chas. W., Co., 3333 La Salle St.

Grace, Wm. Company, 1408 Wabash Av.
Griffiths, John & Son, 1009-1011 Merchants

Loan & Trust Bldg.
Hinschiff, Geo., Co., 188 Madison St.

Lanquist & Illsley Co., 393 North Clark St.
Ledgerwood, A. J. C., 84 La Salle St.

Mavor, William Co., 164 Dearborn St.

Meiling & Walther, 84 La Salle St.
Mueller, Carl R., Builders' & Traders' Exchange, Box 39.

Mueller, Paul P. F., 109 Randolph St.

Noel Construction Co., 108 La Salle St.

Olson Bros. Co., 6501 Peoria St.

Paschen Bros., 115 Dearborn St.

Peterson, W. F., 79 Dearborn St.

Regnall, B. J. Co., 131 La Salle St.

Rodatz, Jacob, The Rookery.

Shedden, James, Co., 92 La Salle St.

Snyder, J. W., Suite 1009-11, 160 Washington St.

Strandberg, E. P., Co., 108 La Salle St.

Stresemreuter Bros., 614 Chamber of Commerce.

Thompson-Starrett Co., Fisher Bldg.

Todd, James & Co., 145 La Salle St.

Warren Construction Co., The (Wm. H. Warwick Construction Co., 324 Dearborn St.

Warren, Prest., Monadnock Blk.

Wells Bros. Company, 1014 Monadnock Blk.

Wilson & Wyld, 140 Dearborn St.

Zadeck, B. M. Co., 811, 135 Adams St.

METAL CEILINGS.

Illinois Metal Ceiling & Supply Co., 23 Lake St.

Knisely Bros., 28th Pl. and 5th Ave.

Krefting, E., 119 W. Van Buren St.

Staar, Frank, 615 N. Halsted St.

Sykes Steel Roofing Co., 112-120 W. 19th Pl.

METAL LATH.

Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

METAL SASH AND FRAMES.

Knisely Bros., 28th Place and 5th Av.

Krefting, E., 119 W. Van Buren St.

Staar, Frank, 615 N. Halsted St.

Volgtman & Company, 42-54 E. Erle St.

METALLIC DOORS.

Dahlstrom Metallic Door Co., Monadnock Blk., and Jamestown, N. Y.
McFarland, J. C. Co., 27th St. & 5th Ave.

MILL WORK.

Bader-Peterson & Co., 21 E. North Ave.
Chicago Sash, Door & Blind Mfg. Co., 48 W. North Av.

Harty Bros. & Harty Co., W. 21st and Loomis Sts.
Mears, Slayton Lumber Co., 1103 Belmont Ave.

Morgan Sash & Door Co., Blue Island Av. and Wood St.
Nollau & Wolff Mfg. Co., 1705 Fullerton North Side Lumber & Timber Co., Lincoln Av. and Grace St.

Paine Lumber Co., Chamber of Commerce.
Peterson, C. E. Co., 4914-22 Wentworth Ave.

MILL WORK—SASH, DOORS AND BLINDS.

Bader-Peterson & Co., 21 E. North Ave.
Chicago Sash, Door & Blind Mfg. Co., 48 W. North Av.

Chicago Veneered Door Co., 316 Chamber of Commerce Bldg.
Harty Bros. & Harty Co., W. 21st and Loomis Sts.

Mears, Slayton Lumber Co., 1103 Belmont Ave.
North Side Lumber & Timber Co., Lincoln Av. and Grace St.

MINERAL WOOL.

Chicago Fire Proof Covering Co., 173 Randolph St.

Union Fibre Company, 1114-15 Great Northern Bldg.

Western Roofing & Supply Co., 2357 La Salle

MODERN VENTILATED ARTIFICIAL STONE HOUSES.

Davis, John E., 620 Chestnut St., St. Louis.

MORTAR COLORS.

Hydraulic Press Brick Co., 3rd Floor Chamber of Commerce Bldg.

Kimball, S. S., Brick Co., 304 Cham. of Com. Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

MORTGAGE LOANS.

Baird & Warner, 90 La Salle St.
Greenbaum Sons, 59 Clark St.

MOSAICS.

Art Marble Co., Flournoy and Rockwell Sts.
Caretti, John & Co., 53 Michigan St.

Marthens, Chester N., Marble Co., 53d and Wallace Sts.

Sherman-Flavin Marble Co., 2505-2509 State St.

MOSAIC—TILE.

Art Marble Co., Flournoy and Rockwell Sts.

MOULDINGS.

Chicago Sash, Door & Blind Mfg. Co., 48 W. North Av.

Harty Bros. & Harty Co., W. 21st and Loomis Sts.

Mears, Slayton Lumber Co., 1103 Belmont Ave.

Morgan Sash & Door Co., Blue Island Av. and Wood St.

Nollau & Wolff Mfg. Co., 1705 Fullerton North Side Lumber & Timber Co., Lincoln Av. and Grace St.

Paine Lumber Co., Chamber of Commerce.
Peterson, C. E. Co., 4914-22 Wentworth Ave.

NATURAL GAS FITTINGS.

Nacey, P. Co., 315-317 Wabash Av.

OFFICE FITTINGS.

Baumann F. O. Mfg. Co., Blackhawk St. and Smith Ave.

OFFICE FIXTURES.

Brunswick-Balke-Collender Co., 263 Wabash Ave.

Chicago Bank & Office Fixture Co., 677-679 W. Van Buren St.
Schweizer & West Mfg. Co., 86-94 North Ada St.

OFFICE FITTINGS AND FURNITURE.
Schweizer & West Mfg. Co., 86-94 North Ada St.

ORNAMENTAL IRON BANK AND OFFICE FIXTURES.

American Bronze Foundry Co., 73rd and Woodlawn Ave.
Chicago Ornamental Iron Works, 37th St. and Stewart Av.
Hanke Iron & Wire Works, 1243-47 Fillmore St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Standard Company, The, Railway Exchange

ORNAMENTAL PATTERNS FOR METAL CASTINGS.

Dux, Joseph, 132 W. Jackson Blvd.

ORNAMENTAL TERRA COTTA.

American Terra Cotta & Ceramic Co., The, 602 Chamber of Commerce Bldg.
Chicago Terra Cotta Co., 1208 Chamber of Commerce Bldg.
Northwestern Terra Cotta Co., The, 1415 Railway Exchange Bldg.

PACKING.

Jenkins Bros., 226 E. Lake St.

PAINT—CEMENT.

Antawaka Co., The, 403 Chamber of Commerce Bldg.
de Smet, Geo. W., Chamber of Commerce Bldg.

PAINT—GRAPHITE.

Adams & Elting Co., 155 W. Washington St.
German-American Paint Co., The, 161 W. Van Buren St.
Heath & Milligan Mfg. Co., 172 Randolph Lucas, John, & Co., 600 S. Morgan St.
Mortell, J. W., Co., The, Kankakee, Ill.

PAINT—IRON.

Adams & Elting Co., 155 W. Washington St.
Chicago Ironite Water Proofing Co., 84 La Salle St.
Garden City Sand Co., The, 134 Washington German-American Paint Co., The, 161 W. Van Buren St.
Heath & Milligan Mfg. Co., 172 Randolph Illinois Damp Proofing Co., The, 145 La Salle St.
Lucas, John, & Co., 600 S. Morgan St.
Mortell, J. W., Co., The, Kankakee, Ill.
Standard Asphalt & Rubber Co., 164 Dearborn St.

PAINT MILLS AND MACHINERY.

Kaestner, Chas. & Co., 241-241 S. Jefferson St.

PAINT—MIXED.

Adams & Elting Co., 155 W. Washington St.
German-American Paint Co., The, 161 W. Van Buren St.
Heath & Milligan Mfg. Co., 172 Randolph Lucas, John, & Co., 600 S. Morgan St.
Mortell, J. W., Co., The, Kankakee, Ill.
Muralo Co., The, 24 Market St.

PAINTERS' SUPPLIES.

Adams & Elting Co., 155 W. Washington St.
Heath & Milligan Mfg. Co., 172 Randolph Lucas, John, & Co., 600 S. Morgan St.
Mortell, J. W., Co., The, Kankakee, Ill.
Muralo Co., The, 24 Market St.

PAINTS.

Adams & Elting Co., 155 W. Washington St.
German-American Paint Co., The, 161 W. Van Buren St.
Heath & Milligan Mfg. Co., 172 Randolph Lucas, John, & Co., 600 S. Morgan St.
Hoore, Benjamin, & Co., 111-117 N. Green St.
Mortell, J. W., Co., The, Kankakee, Ill.
Muralo Co., The, 24 Market St.
Standard Asphalt & Rubber Co., 164 Dearborn St.

PAINTS—COLD WATER.

Adams & Elting Co., 155 W. Washington St.
Chicago Fire Proof Covering Co., 173 Randolph St.
German-American Paint Co., The, 161 W. Van Buren St.
Heath & Milligan Mfg. Co., 172 Randolph Johns-Manville Co. II, W., 173 Randolph St.
Lucas, John, & Co., 600 S. Morgan St.
Muralo Co., The, 24 Market St.
Western Roofing & Supply Co., 2357 La Salle

PAINTING CONTRACTORS.

Hasselgren, R. & Co., 440 N. State St.
McCarthy, E. J. & Co., 1701 Wabash Ave.
McCarthy, J. G., Co., 1832 Wabash Ave.
Noelle, J. B. Co., 56 Fifth Ave.
O'Brien Bros., 751 W. 43rd St.

PAINTS—DAMP PROOFING.

Antawaka Co., The, 403 Chamber of Commerce Bldg.
Chicago Ironite Water Proofing Co., 84 La Salle St.
Illinois Damp Proofing Co., The, 145 La Salle St.
Standard Asphalt & Rubber Co., 164 Dearborn St.
Toch Bros., 320 Fifth Av.

PAINTS—DAMP RESISTING.

Antawaka Co., The, 403 Chamber of Commerce Bldg.
de Smet, Geo. W., Chamber of Commerce Bldg.
Garden City Sand Co., The, 134 Washington Illinois Damp Proofing Co., The, 145 La Salle St.
Standard Asphalt & Rubber Co., 164 Dearborn St.
Toch Bros., 320 Fifth Av.

PAINTS—FIREPROOF.

German-American Paint Co., The, 161 W. Van Buren St.
Muralo Co., The, 24 Market St.

PAINTS—ROOFING.

Adams & Elting Co., 155 W. Washington St.
Chicago Fire Proof Covering Co., 173 Randolph St.
German-American Paint Co., The, 161 W. Van Buren St.
Heath & Milligan Mfg. Co., 172 Randolph Lucas, John, & Co., 600 S. Morgan St.
Mortell, J. W., Co., The, Kankakee, Ill.
Muralo Co., The, 24 Market St.
Standard Asphalt & Rubber Co., 164 Dearborn St.
Western Roofing & Supply Co., 2357 La Salle

PAVING CONTRACTORS.

American Asphaltum & Rubber Co., 234 Michigan Ave.
Kettle River Quarries Co., 1033 First Nat. Bank Bldg., Chicago, Ill.

PHYSICAL LABORATORY.

Hunt, Robert W. & Co., 1121 The Rookery.
PILING—CONCRETE.

Jackson, George W. (Inc.), 169-179 W. Jackson Blvd.
Raymond Concrete Pile Co., 135 Adams St.

PILING—SHEET STEEL.

Jackson, George W. (Inc.), 169-179 W. Jackson Blvd.

PILING.

Lake Superior Piling Co., 22nd and Morgan Sts.

PILING DEALERS.

Lake Superior Piling Co., 22nd and Morgan Sts.

PILING MANUFACTURERS.

Lake Superior Piling Co., 22nd and Morgan Sts.

PILING—WOOD.

Jackson, George W. (Inc.), 169-179 W. Jackson Blvd.
Lake Superior Piling Co., 22nd and Morgan Sts.

PIPE AND BOILER COVERING.

Chapman, Richard W., Co., 2656-8 N. Hamlin Ave.

Chicago Fire Proof Covering Co., 173 Randolph St.

Garden City Sand Co., The, 134 Washington Johns-Manville Co., H. W., 173 Randolph St.
Western Roofing & Supply Co., 2357 La Salle

PLASTER.

Architectural Decorating Co., 643 S. Jefferson.
Builders & Decorators Supply Co., 152 Veder St.

Decorators' Supply Co., The, Archer Av. & Leo St.

Jenkins & Reynolds Co., The, 1210 Chamber of Commerce.

Plastic Relief Mfg. Co., The, 298 N. Halsted St.

PLASTER—ORNAMENTAL.

Architectural Decorating Co., 643 S. Jefferson.
Builders & Decorators Supply Co., 152 Veder St.

Decorators' Supply Co., The, Archer Av. & Leo St.

Plastic Relief Mfg. Co., The, 298 N. Halsted St.

PLASTERING.

Eastman Co., The, 108 La Salle St.

Lennox-Haldeman Co., 134 Monroe St.

McNulty Bros., 1455 Railway Exchange Bldg.

Middleton, Edward, Chamber of Commerce

Sutton, John C. Co., 636 First Nat. Bank Bldg.

Zander-Reum Co., 508 Lakeside Bldg.

PLASTERING CONTRACTORS.

Eastman Co., The, 108 La Salle St.

Lennox-Haldeman Co., 134 Monroe St.

McNulty Bros., 1455 Railway Exchange Bldg.

Middleton, Edward, Chamber of Commerce

Sutton, John C. Co., 636 First Nat. Bank Bldg.

Zander-Reum Co., 508 Lakeside Bldg.

PLASTERING LATH.

Roebling Construction Co., The, Stock Exchange Bldg.

Voss, Frederick, 617 to 621 Austin Av.

PLASTERING MATERIAL.

Garden City Sand Co., The, 134 Washington Jenkins & Reynolds Co., The, 1210 Chamber of Commerce.

Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

PLASTIC RELIEF.

Architectural Decorating Co., 643 S. Jefferson.
Builders & Decorators Supply Co., 152 Veder St.

Decorators' Supply Co., The, Archer Av. & Leo St.

Plastic Relief Mfg. Co., The, 298 N. Halsted St.

PLUMBERS' SUPPLIES.

Dube, John J., 401-56 Fifth Ave.

PLUMBING, GASFITTING AND SEWER-AGE.

Farwell, B. J., 42 Sherman St.

Hanley-Casey Co., 37 Ohio St.

Nacey, P. Co., 315-317 Wabash Av.

Nilson Bros., 901 Belmont Ave.

Noble & Thumm, 292 Lincoln Av.

Wills & Smith, 5938 S. Halsted St.

PNEUMATIC TOOLS.

Scully Steel & Iron Co., Halsted and Fulton Sts.

PORTLAND CEMENT.

Garden City Sand Co., The, 134 Washington Knickerbocker Ice Co., 171 La Salle St.

POST CAPS.

Ritter, Emil W. Co., The, 40 Dearborn St.

POWER GENERATORS.

Street, R. R. & Co., 184-186 Washington St.

POWER HOUSE CONSTRUCTION.

Warwick Construction Co., 324 Dearborn St.

POWER PIPING.

Evans, Almirall & Co., 1208 Monadnock Bldg

POWER PLANTS.

Evans, Almirall & Co., 1208 Monadnock Bldg.

Glenmon, Charles & Co., 30 La Salle St.

Graves, W. B., Co., 121 Kinzie St.

Kaestner, Chas. & Co., 241-261 S. Jefferson St.

Lees, William, 97 S. Clinton St.

Western Electric Co., 259 S. Clinton St.

POWER PUMPS.

McMaster-Carr Supply Co., 174 Lake St.

Rider-Eriesson Engine Co., 40 Dearborn St.

PREPARED ROOFING MATERIAL.

Chicago Fire Proof Covering Co., 173 Randolph St.

Western Roofing & Supply Co., 2357 La Salle

PRESSURE HEATING.

Davis, G. M., Regulator Co., 114-146 Milwaukee Av.

Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

PRISMATIC LIGHTS.

Ritter, Emil W. Co., The, 40 Dearborn St.

PUMPING MACHINERY.

Kehm Bros. Co., 13-15 W. Kinzie St.

McMaster-Carr Supply Co., 174 Lake St.

Rider-Eriesson Engine Co., 40 Dearborn St.

PUMPS.

Kroeschell Bros. Co., 55 Erie St.

McMaster-Carr Supply Co., 174 Lake St.

Rider-Eriesson Engine Co., 40 Dearborn St.

PUMPS—AUTOMATIC AND HYDRAULIC.

Kehm Bros. Co., 13-15 W. Kinzie St.

Rider-Eriesson Engine Co., 40 Dearborn St.

PUMPS—ELECTRIC.

Rider-Eriesson Engine Co., 40 Dearborn St.

PURIFIERS—WATER.

Loomis-Manning Filter Co., 826 Land Title Bldg., Philadelphia, Pa.

PIPE AND BOILER COVERING.

Chapman, Richard W. Co., 2656-8 N. Hamlin Ave.

RADIATORS.

Arcade Steam Heating Co., 153 Kinzie St.

Kroeschell Bros. Co., 55 Erie St.

RADIATOR SHIELDS.

Chapman, Richard W. Co., 2656 N. Hamlin Av.

RAILINGS AND GRILLES—BRASS.

American Bronze Foundry Co., 73rd and Woodlawn Ave.

Brown Bros. Mfg. Co., 22nd St. and Campbell Av.

Heath-Johnson Co., 127 E. Ontario St.

Standard Company, The, Railway Exchange

REAL ESTATE LOANS.

Baird & Warner, 90 La Salle St.

Greenebaum Sons, 59 Clark St.

REFRIGERATING AND ICE MAKING MACHINERY.

Creamery Package Mfg. Co., The, 184 Kinzie St.

Kroeschell Bros. Co., 55 Erie St.

Kroeschell Bros. Co., 55 Erie St.

Wolff, Fred W. Co., The, 139 Rees St.

REFRIGERATORS.

Brunswick-Balke-Collender Co., 263 Wabash Ave.

Cobb, Whyte & Laemmer Co., 45 Clark St.

McCray Refrigerator Co., 55 Wabash Ave., Chicago; Kendallville, Ind.
Michels, N., Hardware, 1661 Lincoln Ave.
Orr & Lockett Hardware Co., 71-73 Randolph.

REFRIGERATORS—HOTEL.

Creamery Package Mfg. Co., The, 184 Kinzie St.

REGULATORS.

Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

REGULATORS—DAMPER.

Davis, G. M., Regulator Co., 144-146 Milwaukee Av.

REGULATORS—HEAT, STEAM, AIR, WATER.

Davis, G. M., Regulator Co., 144-146 Milwaukee Av.

Johnson Service Co., 93 Lake St.
Powers Regulator Co., The, 40 Dearborn St.

REINFORCED CONCRETE.

Hoeffer & Co., Chamber of Commerce Bldg.

REINFORCING BARS—CONCRETE.

American Steel & Wire Co., Com'l Nat. Bk. Bldg.

American System of Reinforcing, 189 La Salle St.

Calumet Steel Co., Com'l Nat. Bank Bldg.
Lock Bar Steel Concrete Co., Com'l Nat. Bk. Bldg.

REINFORCED CONCRETE CONSTRUCTION.

Alling Construction Co., 72 Madison St.
Climax Co., 1005 Tacoma Bldg.

Ferro Concrete Construction Co., The, Stock Exchange Bldg.

Hoeffer & Co., Chamber of Commerce Bldg.
Pleas Concrete Construction Co., 503—160 Washington St.

Warwick Construction Co., 324 Dearborn St.
Wilson & Wyld, 140 Dearborn St.

RESERVOIRS.

Hoeffer & Co., Chamber of Commerce Bldg.

RIVETS, BANDS, HOOPS, BARS, BOLTS.

Scully Steel & Iron Co., Halsted and Fulton Sts.

ROLLING PARTITIONS.

Dodge, H. B., & Co., 525, 108 La Salle St.

ROLLING PARTITIONS—WOOD AND STEEL.

Dodge, H. B. & Co., 525, 108 La Salle St.

ROOFING.

American Asphaltum & Rubber Co., 234 Michigan Ave.

Illinois Roofing & Cornice Co., 319 W. Kinzie St.

Johns-Manville Co., H. W., 173 Randolph St.
Knickerbocker Roofing & Paving Co., 138 Washington St.

Knitsely Co., Harry C., 273 S. Canal St.
Moore-Maguire Roofing Co., 1011 Chamber of Commerce.

National Roofing Co., 3223 La Salle St.
Powell, M. W. Co., 204 Dearborn St.

Standard Roofing Co., 290-294 N. Halsted St.
Stoops, G. B., & Bro., 449 Grand Av.

ROOFING—ASBESTOS.

Barrett Mfg. Co., 164 Dearborn St.
Chicago Fire Proof Covering Co., 173 Randolph St.

Johns-Manville Co., H. W., 173 Randolph St.
Western Roofing & Supply Co., 2357 La Salle

ROOFING—CORRUGATED IRON.

Calumet Steel Co., Com'l Nat. Bank Bldg.
Illinois Roofing & Cornice Co., 319 W. Kinzie St.

Knitsely Bros., 28th Place and 5th Av.
Knitsely Co., Harry C., 273 S. Canal St.

Krefting, E., 119 W. Van Buren St.
McFarland, J. C. Co., 27th St. & 5th Ave.

Scully Steel & Iron Co., Halsted and Fulton Sts.

Staar, Frank, 615 N. Halsted St.
Sykes Steel Roofing Co., 112-120 W. 19th Pl.

ROOFING—GENERAL.

American Asphaltum & Rubber Co., 234 Michigan Ave.

Knickerbocker Roofing & Paving Co., 138 Washington St.

Moore-Maguire Roofing Co., 1011 Chamber of Commerce.

National Roofing Co., 3223 La Salle St.

Powell, M. W. Co., 204 Dearborn St.

Standard Asphalt & Rubber Co., 164 Dearborn St.

Standard Roofing Co., 290-294 N. Halsted St.

Stoops, G. B., & Bro., 449 Grand Av.

ROOFING—GRAVEL.

American Asphaltum & Rubber Co., 234 Michigan Ave.

Knickerbocker Roofing & Paving Co., 138 Washington St.

Moore-Maguire Roofing Co., 1011 Chamber of Commerce.

National Roofing Co., 3223 La Salle St.

Powell, M. W. Co., 204 Dearborn St.

Standard Roofing Co., 290-294 N. Halsted St.

Stoops, G. B., & Bro., 449 Grand Av.

Sykes Steel Roofing Co., 112-120 W. 19th Pl.

ROOFING MATERIALS.

American Asphaltum & Rubber Co., 234 Michigan Ave.

Barrett Mfg. Co., 164 Dearborn St.

Garden City Sand Co., The, 134 Washington Johns-Manville Co., H. W., 173 Randolph St.

Knickerbocker Roofing & Paving Co., 138 Washington St.

Moore-Maguire Roofing Co., 1011 Chamber of Commerce.

National Roofing Co., 3223 La Salle St.

Powell, M. W. Co., 204 Dearborn St.

Standard Asphalt & Rubber Co., 164 Dearborn St.

Standard Roofing Co., 290-294 N. Halsted St.

Stoops, G. B., & Bro., 449 Grand Av.

Western Roofing & Supply Co., 2357 La Salle

ROOFING PAINTS.

American Asphaltum & Rubber Co., 234 Michigan Ave.

Barrett Mfg. Co., 164 Dearborn St.

Heath & Milligan Mfg. Co., 172 Randolph Johns-Manville Co., H. W., 173 Randolph St.

Standard Asphalt & Rubber Co., 164 Dearborn St.

Western Roofing & Supply Co., 2357 La Salle

ROOFING PAPER.

Barrett Mfg. Co., 164 Dearborn St.

Johns-Manville Co., H. W., 173 Randolph St.

Western Roofing & Supply Co., 2357 La Salle

ROOFING—SLAG.

Ill. Improvement & Ballast Co., 115 Adams St. City.

ROOFING—SLATE AND TILE.

Illinois Roofing & Cornice Co., 319 W. Kinzie St.

Knitsely Co., Harry C., 273 S. Canal St.

McFarland, J. C. Co., 27th St. & 5th Ave.

ROOFING—TIN, SLATE, TILE AND METAL.

Illinois Roofing & Cornice Co., 319 W. Kinzie St.

Knitsely Bros., 28th Place and 5th Av.

Knitsely Co., Harry C., 273 S. Canal St.

Krefting, E., 119 W. Van Buren St.

Staar, Frank, 615 N. Halsted St.

Sykes Steel Roofing Co., 112-120 W. 19th Pl.

ROPE TRANSMISSION MACHINERY.

Jeffrey Mfg. Co., Monadnock Bldg., and Colum-

bus, Ohio.

Kaestner, Chas. & Co., 241-261 S. Jefferson St.

Olson Brothers, 705 Bloomingdale Av.

Webster Mfg. Co., 1075 W. 15th St.

Weller Mfg. Co., 118 East North Ave.

RUBBER BELTING.

Allen, W. D., Mfg. Co., 151 Lake St.

RUBBER GOODS.

Allen, W. D., Mfg. Co., 151 Lake St.

RUBBER HOSE.

Allen, W. D., Mfg. Co., 151 Lake St.

RUBBER TILE.

New York Belting & Packing Co., Ltd., 150 Lake St.

RUBBER TILING—FLOORS FOR ELEVATORS AND PUBLIC PLACES.

New York Belting & Packing Co., Ltd., 150 Lake St.

SAFES.

Harris, S. H. Co., The, 29 Pearce St.

SAFES—BANK.

Harris, S. H. Co., The, 29 Pearce St.

SAFETY DEPOSIT VAULTS.

Chamber of Commerce Safety Vault Co., Chamber of Commerce, 132 Washington St.

SAND.

American Sand & Gravel Co., 907 Cham. of Com. Bldg.
Garden City Sand Co., The, 134 Washington Knickerbocker Ice Co., 171 La Salle St.
Newman, W. J., 50 S. Curtis St.
Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

SAND AND GRAVEL.

American Sand & Gravel Co., 907 Cham. of Com. Bldg.
Garden City Sand Co., The, 134 Washington Knickerbocker Ice Co., 171 La Salle St.

SASH CORD.

Samson Cordage Works, 115 Congress St., Boston, Mass.

SASH, DOORS AND BLINDS.

Chicago Sash, Door & Blind Mfg. Co., 48 W. North Av.
Harty Bros. & Harty Co., W. 21st and Loomis Sts.
Mears, Slayton Lumber Co., 1103 Belmont Ave.
Morgan Sash & Door Co., Blue Island Av. and Wood St.
Nollau & Wolff Mfg. Co., 1705 Fullerton
Paine Lumber Co., Chamber of Commerce.
Peterson, C. E. Co., 4914-22 Wentworth Ave.

SCRAPERS.

Scully Steel & Iron Co., Halsted and Fulton Sts.

SCOGTROLA.

Art Marble Co., Flournoy and Rockwell Sts.

SEPARATORS—STEAM AND OIL.

Webster, Warren & Co., 1510 Monadnock Bld.

SECURITY BONDS FOR CONTRACTORS.

Joyce & Co., 217 La Salle St.

Marsh & McLennan, 159 La Salle St.

SEWER BUILDERS—PUBLIC AND PRIVATE.

Nacey, P. Co., 315-317 Wabash Av.

SHEATHING PAPER.

Barrett Mfg. Co., 164 Dearborn St.
Cabot, Samuel, 28 Dearborn Ave. and Boston, Mass.

Johns-Manville Co., H. W., 173 Randolph St.
Union Fibre Company, 1114-15 Great Northern Bldg.

Western Roofing & Supply Co., 2357 La Salle

SHEET STEEL—BLACK AND GALVANIZED.

Scully Steel & Iron Co., Halsted and Fulton Sts.

SHELVES—STEEL FOR FACTORIES.

Durand Steel Locker Co., 125 Monroe St.

SHEET METAL WORKS.

Narowetz, Louis, 13-15 W. Kinzie St.

SHINGLES.

Burns, John E., Lumber Co., 40 W. Chicago Av.

Hines, Edw., Lumber Co., 1124 S. Lincoln St.
Winthrop Asphalt Shingle Co., The, 1102-184 La Salle St.

SHINGLES—FIRE RESISTING, WATER-PROOF, LIGHTNING AND WIND-PROOF.

Winthrop Asphalt Shingle Co., The, 1102-184 La Salle St.

SHINGLE STAINS.

Cabot, Samuel, 28 Dearborn Ave. and Boston, Mass.

German-American Paint Co., The, 161 W. Van Buren St.

Johns-Manville Co., H. W., 173 Randolph St.
Lucas, John, & Co., 600 S. Morgan St.

SHOW CASE BARS.

Kawneer Mfg. Co., 1640 Unity Bldg., and Niles, Mich.

SIDEWALK BUILDERS.

Blome, Rudolph S. Co., 79 Dearborn St.
Hoeffer & Co., Chamber of Commerce Bldg.

Pleas Concrete Construction Co., 503-160 Washington St.

Simpson Construction Co., 704 Cham. of Com.
Standard Concrete Construction Co., 184 La Salle St.

SIDEWALKS—SLAG.

III. Improvement & Ballast Co., 115 Adams St. City.

SIDEWALK AND VAULT LIGHTS.

American Luxfer Prism Co., Heyworth Bldg.
Brown Bros. Mfg. Co., 22d St. & Campbell Av.

Ritter, Emil W. Co., The, 40 Dearborn St.

SKYLIGHTS.

Anti-Pluvius Skylight Co., 40 Dearborn St.
Ritter, Emil W. Co., The, 40 Dearborn St.

SKYLIGHT VENTILATORS.

Ritter, Emil W. Co., The, 40 Dearborn St.

SLUICE GATES.

Jenkins Bros., 226 E. Lake St.

SMOKELESS FURNACES.

Kroeschell Bros. Co., 55 Erie St.

Ritter, Emil W. Co., The, 40 Dearborn St.

SMOKE STACKS—BRICK OR STEEL.

Warwick Construction Co., 324 Dearborn St.

SPRINKLER SYSTEM.

Ever Ready Mfg. Co., 1403 Fisher Bldg.

STABLE FIXTURES.

Heath-Johnson Co., 127 E. Ontario St.

STABLE FIXTURES—WIRE AND IRON.

American Iron & Wire Works, 575-581 Carroll Ave.

Central Iron Works of Chicago, 263-265 West Lake St.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Smith, F. P. Wire & Iron Works, 100 Lake St.

Voss, Frederick, 617 to 621 Austin Av.

STAIRS—IRON AND BRONZE.

American Bronze Foundry Co., 73rd and Woodlawn Ave.

Brown Bros. Mfg. Co., 22nd St. and Campbell Av.

Chicago Ornamental Iron Works, 37th St. and Stewart Ave.

Standard Company, The, Railway Exchange

STAIR WORK.

Baumann F. O. Mfg. Co., Blackhawk St. and Smith Ave.

Harty Bros. & Harty Co., W. 21st and Loomis Sts.

Linquist, A. D., & Co., 705 Bloomingdale Rd.

Peterson, C. E. Co., 1911-22 Wentworth Ave.

STAIRS AND RAILINGS.

Baumann F. O. Mfg. Co., Blackhawk St. and Smith Ave.
Linquist, A. D., & Co., 705 Bloomingdale Rd.
Peterson, C. E. Co., 4914-22 Wentworth Ave.

STAND PIPES.

Central Iron Works of Chicago, 263-265 West Lake St.
Hanke Iron & Wire Works, 1243-47 Fillmore St.
Kroeschell Bros. Co., 55 Erie St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Voss, Frederick, 617 to 621 Austin Av.

STATUARY—BRONZE.

American Bronze Foundry Co., 73rd and Woodlawn Ave.

STATUARY—METAL.

Smith, F. P. Wire & Iron Works, 100 Lake St.
Winslow Bros. Co., The, W. Harrison St., 46th & 47th Avs.

STEAM BOILERS.

Kewanee Boiler Co., 35 Michigan Av.
Richardson & Boynton Co., 20 Lake St.
Union Iron Works, 1403 Fisher Bldg.

STEAM ELEVATORS.

Altizer & Prince Co., 51 Michigan St.
Otis Elevator Company, 9 Jackson Blvd.
Reedy, J. W. Elevator Mfg. Co., 91 Illinois St.

STEAM FITTERS AND MACHINISTS.

Dilzer Fred, 48 Dearborn St.
Kroeschell Bros Co., 55 Erie St.
Phillips Getschow Co., 184 Indiana St.
Pope, William A., 80 Lake St.
Purves Heating Co., 215 Fifth Av.

STEAM FITTERS' MATERIAL.

Davis, G. M., Regulator Co., 114-116 Milwaukee Av.

STEAM GENERATORS.

Kewanee Boiler Co., 35 Michigan Av.
Union Iron Works, 1403 Fisher Bldg.

STEAM HEATING APPARATUS.

Carboy, M. J., 78 Dearborn St.
Davis, G. M., Regulator Co., 114-116 Milwaukee Av.

Deppmann, A. & Co., 212 Illinois St.
Deppmann, L., 1599 Lincoln Ave.

Dilzer, Fred, 48 Dearborn St.

Dube, John J., 401-56 Fifth Ave.

Evans, Almirall & Co., 1208 Monadnock Bldg.
Farwell, E. J., 42 Sherman St.

Glennon, Charles & Co., 30 La Salle St.

Graves, W. B., Co., 121 Kinzie St.

Hanley-Casey Co., 37 Ohio St.

Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

Ideal Heating Co., 6312 Wentworth Av.

Illinois Malleable Iron Co., 537 Diversey Blvd.

Kehm Bros. Co., 13-15 W. Kinzie St.

Kilander, A. & Co., 141 S. Clinton St.

Kirk, Geo. H., 6612 Wentworth Av.

Kroeschell Bros. Co., 55 Erie St.

Lees, William, 97 S. Clinton St.

Mueller, L. J., Furnace Co., 409 Dearborn St., and Milwaukee, Wis.

Narowetz, Louis, 13-15 W. Kinzie St.

Nilson Bros., 901 Belmont Ave.

Noble & Thumm, 292 Lincoln Av.

Norton, F. J., 8 North State St.

Phillips-Getschow Co., 184 Indiana St.

Pope, William A., 80 Lake St.

Purves Heating Co., 215 Fifth Av.

Richardson & Boynton Co., 20 Lake St.

Thomas & Smith, 17-19 S. Carpenter St.
Wills & Smith, 5938 S. Halsted St.

STEAM TRAPS.

Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

McMaster-Carr Supply Co., 174 Lake St.

STEEL BARS FOR REINFORCING CONCRETE.

American Steel & Wire Co., Com'l Nat. Bk. Bldg.

American System of Reinforcing, 189 La Salle St.
Calumet Steel Co., Com'l Nat. Bank Bldg.
Lock Bar Steel Concrete Co., Com'l Nat. Bk. Bldg.
Scully Steel & Iron Co., Halsted and Fulton Sts.

STEEL CORNER BEAD.

Sharon Steel Hoop Co., 115 Adams St.

STEEL RIBS AND LAGGING.

Jackson, George W., Inc., 169-179 W. Jackson Blvd.

STEEL ROLLING DOORS, SHUTTERS AND PARTITIONS.

Dodge, H. B. & Co., 525, 108 La Salle St.
Hanke Iron & Wire Works, 1243-47 Fillmore St.

Kinnear Mfg. Co., The, 206 La Salle St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Voss, Frederick, 617 to 621 Austin Av.

STEEL AND WOOD CABINETS.

STONE—ARTIFICIAL.

Davis, John E., 620 Chestnut St., St. Louis.

STONE—BRIDGE.

Bedford Quarries Co., The, Room 638, 204 Dearborn St.
Chicago Cut Stone Co., 3403-7 La Salle St.
Consolidated Stone Co., The, Monadnock Blk.
Kettle River Quarries Co., 1033 First Nat. Bank Bldg., Chicago, Ill.

McMillan, W., & Son, Cham. of Com. Bldg.
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STONE—BUILDING.

Bedford Quarries Co., The, Room 638, 204 Dearborn St.

Chicago Cut Stone Co., 3403-7 La Salle St.
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Kettle River Quarries Co., 1033 First Nat. Bank Bldg., Chicago, Ill.

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Holmes, Pyott & Co., 13 N. Jefferson St.
Jenmet Bridge & Iron Wks., 3541 Shields Av.

Kenwood Bridge Co., First Nat'l Bank Bldg.
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Scully Steel & Iron Co., Halsted and Fulton.

Smith, F. P. Wire & Iron Works, 100 Lake St.
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Marsh & McLennan, 159 La Salle St.

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Emerson, H. L., 1206 Chamber of Commerce

Greeley-Howard Co., S22, 112 Clark St.

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Dietzgen, Eugene Co., 181 Monroe St.

Keuffel & Esser Co., 111 Madison St.

TABLETS AND NAMEPLATES—IRON AND BRONZE.

American Bronze Foundry Co., 73rd and Woodlawn Ave.

Brown Bros. Mfg. Co., 22d St. & Campbell Av.

Chicago Ornamental Iron Works, 37th St. and Stewart Ave.

Standard Company, The, Railway Exchange

TANKS—IRON AND STEEL.

Kaestner, Chas., & Co., 241-261 S. Jefferson St.

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Western Electric Co., 259 S. Clinton St.

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McMaster-Carr Supply Co., 174 Lake St.

Powers Regulator Co., The, 40 Dearborn St.

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American Terra Cotta & Ceramic Co., The, 602 Chamber of Commerce Bldg.

Chicago Terra Cotta Co., 1208 Chamber of Commerce Bldg.

Northwestern Terra Cotta Co., The, 1415 Fullway Exchange Bldg.

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Johnson Service Co., 93 Lake St.

Powers Regulator Co., The, 40 Dearborn St.

TILE—FLOORS.

Art Marble Co., Flournoy and Rockwell Sts.

Caretti, John & Co., 53 Michigan St.

Marthens, Chester N., Marble Co., 53d and Wallace Sts.

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Sherman-Flavin Marble Co., 2505-2509 State St.

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New York Belting & Packing Co., Ltd., 150 Lake St.

TILE—WALL.

Caretti, John & Co., 53 Michigan St.

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Sherman-Flavin Marble Co., 2505-2509 State St.

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Sherman-Flavin Marble Co., 2505-2509 State St.

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Jenkins Bros., 226 E. Lake St.

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Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

Jenkins Bros., 226 E. Lake St.

VALVES—AIR.

Jenkins Bros., 226 E. Lake St.

McMaster-Carr Supply Co., 174 Lake St.

VALVES—AIR, CHECK BALANCE.

Davis, G. M., Regulator Co., 144-146 Milwaukee Av.

Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

VALVES—ALL KINDS.

Jenkins Bros., 226 E. Lake St.

VALVES—BLOW-OFF.

Scully Steel & Iron Co., Halsted and Fulton Sts.

VALVES—BACK PRESSURE.

Davis, G. M., Regulator Co., 144-146 Milwaukee Av.

Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

Jenkins Bros., 226 E. Lake St.

VALVES—POP.

Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

Jenkins Bros., 226 E. Lake St.

VALVES—PRESSURE REDUCING.

Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

Jenkins Bros., 226 E. Lake St.

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Davis, G. M., Regulator Co., 144-146 Milwaukee Av.

Hughson Steam Specialty Co., 743 First Nat'l Bank Bldg.

McMaster-Carr Supply Co., 174 Lake St.

VALVES—RELIEF.

Davis, G. M., Regulator Co., 144-146 Milwaukee Av.
Highson Steam Specialty Co., 743 First Nat'l Bank Bldg.

VALVES—VACUUM.

Davis, G. M., Regulator Co., 144-146 Milwaukee Av.
Webster, Warren & Co., 1510 Monadnock Bldg.

VARNISHES.

American Varnish Co., 315 North Branch.
Berry Brothers, Ltd., 25 Lake St.
Chicago Varnish Co., Dearborn Av. and Kinzie St.
Cleveland Varnish Co., 163 Canal St.
Heath & Milligan Mfg. Co., 172 Randolph Moore, Benjamin, & Co., 111-117 N. Green St.
Murphy Varnish Co., 22nd and Dearborn Sts.
Pratt & Lambert, 370 26th St.
Standard Varnish Works, 2620 Armour Av.

VAULT DOORS.

Harris, S. H. Co., The, 29 Pearce St.

VAULTS—BANK.

Harris, S. H. Co., The, 29 Pearce St.

VENETIAN BLINDS.

Dodge, H. B. & Co., 525, 108 La Salle St.

VENTILATING APPARATUS.

Commonwealth-Edison Co., 139 Adams St.
Deppmann, A. & Co., 212 Illinois St.
Deppmann, L., 1599 Lincoln Ave.
Evans, Almirall & Co., 1205 Monadnock Bldg.
Graves, W. B., Co., 121 Kinzie St.
Ilg Electric Ventilating Co., 221 E. Kinzie St.
Kehm Bros. Co., 13-15 W. Kinzie St.
Kilander, A. & Co., 141 S. Clinton St.
Kirk, Geo. H., 6612 Wentworth Av.
Lees, William, 97 S. Clinton St.
Mueller, L. J., Furnace Co., 40 Dearborn St., and Milwaukee, Wis.
Narowetz, Louis, 13-15 W. Kinzie St.
Phillips-Getschow Co., 184 Indiana St.
Prentice, L. H. Co., 24-26 Sherman St.
Thomas & Smith, 17-19 S. Carpenter St.
Webster, Warren & Co., 1510 Monadnock Bldg.
Western Electric Co., 259 S. Clinton St.

VENTILATORS.

Burt Mfg. Co., 40 Dearborn St., and Akron, Ohio.
Ilg Electric Ventilating Co., 221 E. Kinzie St.
Narowetz, Louis, 13-15 W. Kinzie St.
Ritter, Emil W. Co., The, 40 Dearborn St.

VENTILATING FANS.

Western Electric Co., 259 S. Clinton St.

WALL COPING.

Chicago Terra Cotta Co., 1205 Chamber of Commerce Bldg.
Garden City Sand Co., The, 134 Washington Hydraulic Press Brick Co., 3rd Floor Chamber of Commerce Bldg.
Northwestern Terra Cotta Co., The, 1415 Rallway Exchange Bldg.

WALL DECORATIONS.

German-American Paint Co., The, 161 W. Van Buren St.

Moore, Benjamin, & Co., 111-117 N. Green St.

WALL PLASTER.

Garden City Sand Co., The, 134 Washington Wisconsin Lime & Cement Co., 607 Chamber of Commerce.

WALL PAPER.

Hasselgren, R. & Co., 440 N. State St.
McCarthy, E. J. & Co., 1704 Wabash Ave.
McCarthy, J. G., Co., 1832 Wabash Ave.
Noelle, J. B. Co., 56 Fifth Ave.
O'Brien Bros., 751 W. 43rd St.

WALL PLUGS.

Kawneer Mfg. Co., 1640 Unity Bldg., and Niles, Mich.

Ritter, Emil W. Co., The, 40 Dearborn St.

WARDROBES—STEEL.

Durand Steel Locker Co., 125 Monroe St.

WALL TIES.

Ritter, Emil W. Co., The, 40 Dearborn St.

WARDROBES—VENTILATED.

Dodge, H. B. & Co., 525, 108 La Salle St.

WASHING MACHINES—ELECTRIC.

Judd Oscillating Cleaner Co., 420-471 La Salle St.

WATER FILTERS.

Loomis-Manning Filter Co., 826 Land Title Bldg., Philadelphia, Pa.

WATER HEATERS.

Dube, John J., 401-56 Fifth Ave.

WATERPROOFING.

American Asphaltum & Rubber Co., 234 Michigan Ave.

Antawaka Co., The, 403 Chamber of Commerce Bldg.

Chicago Ironite Water Proofing Co., 84 La Salle St.

de Smet, Geo. W., Chamber of Commerce Bldg.

Hoeffer & Co., Chamber of Commerce Bldg.
Illinois Damp Proofing Co., The, 145 La Salle St.

National Water Proof Co., 234 Michigan Ave.

Standard Asphalt & Rubber Co., 164 Dearborn St.

WATER PURIFIERS.

Loomis-Manning Filter Co., 826 Land Title Bldg., Philadelphia, Pa.

WATER WORKS, STEAM, ELECTRIC AND GAS HEATING PLANTS.

Evans, Almirall & Co., 1205 Monadnock Bldg.
Schott Engineering Co., The, Manhattan Bldg.

WATER AND STEAM BOILERS.

Arcade Steam Heating Co., 153 Kinzie St.
Ideal Heating Co., 6312 Wentworth Av.

WEATHER STRIPS.

Chamberlin Metal Weather Strip Co., 570 Old Colony Bldg.

Chicago Metal Weather Strip Co., 856 N. Troy St.

National Metal Weather Strip Co., 17 Quincy

WEATHER STRIPS—METAL.

Chamberlin Metal Weather Strip Co., 570 Old Colony Bldg.

Chicago Metal Weather Strip Co., 856 N. Troy St.

National Metal Weather Strip Co., 17 Quincy

WINDOWS—WIRE GLASS.

McFarland, J. C. Co., 27th St. & 5th Ave.
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Sykes Steel Roofing Co., 112-120 W. 19th Pl.
Voigtman & Company, 42-54 E. Erie St.

WIRE FABRIC—CONCRETE REINFORCING.

American System of Reinforcing, 189 La Salle St.

WIRE CLOTH.

Roebling Construction Co., The, Stock Exchange Bldg.

Smith, F. P. Wire & Iron Works, 100 Lake St.

WIRE CLOTH AND ROPE.

Scully Steel & Iron Co., Halsted and Fulton Sts.

WIRE FENCE AND RAILINGS.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

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Mississippi Wire & Glass Co., 72 Madison St.
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WIRE GUARDS AND SCREENS.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Standard Company, The, Railway Exchange

WIRE PARTITIONS.

American Iron & Wire Works, 575-581 Carroll Ave.

WIRE SASH AND FRAMES—GLAZED.

McFarland, J. C. Co., 27th St. & 5th Ave.
Voigtman & Company, 42-54 E. Erie St.

WIRE WORK.

American Iron & Wire Works, 575-581 Carroll Ave.

Hanke Iron & Wire Works, 1243-47 Fillmore St.

Heath-Johnson Co., 127 E. Ontario St.

Smith, F. P. Wire & Iron Works, 100 Lake St.
Standard Company, The, Railway Exchange
Voss, Frederick, 617 to 621 Austin Av.

**WIRELESS CLUSTERS—STANDARD AND
SEPARABLE.**

Benjamin Electric Mfg. Co., 42 W. Jackson
Blvd.
Western Electric Co., 259 S. Clinton St.

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PROOFING.**

American Steel & Wire Co., Com'l Nat. Bk.
Bldg.

WOOD CARVING.

Architectural Decorating Co., 643 S. Jefferson.
Builders & Decorators Supply Co., 152 Veder
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Decorators' Supply Co., The, Archer Av. &
Leo St.
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Plastic Relief Mfg. Co., The, 298 N. Hal-
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WOOD COLUMNS.

Hartman-Sanders Co., Elston and Webster
Ave.

WOOD MANTELS AND CONSOLES.

Pickens, Edward, Co., 179 Wabash Ave.

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Lake Superior Piling Co., 22nd and Mor-
gan Sts.

WOOD TURNING.

Hartman-Sanders Co., Elston and Webster
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Hilger & Co., 237 Michigan Ave.

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MENTS.**

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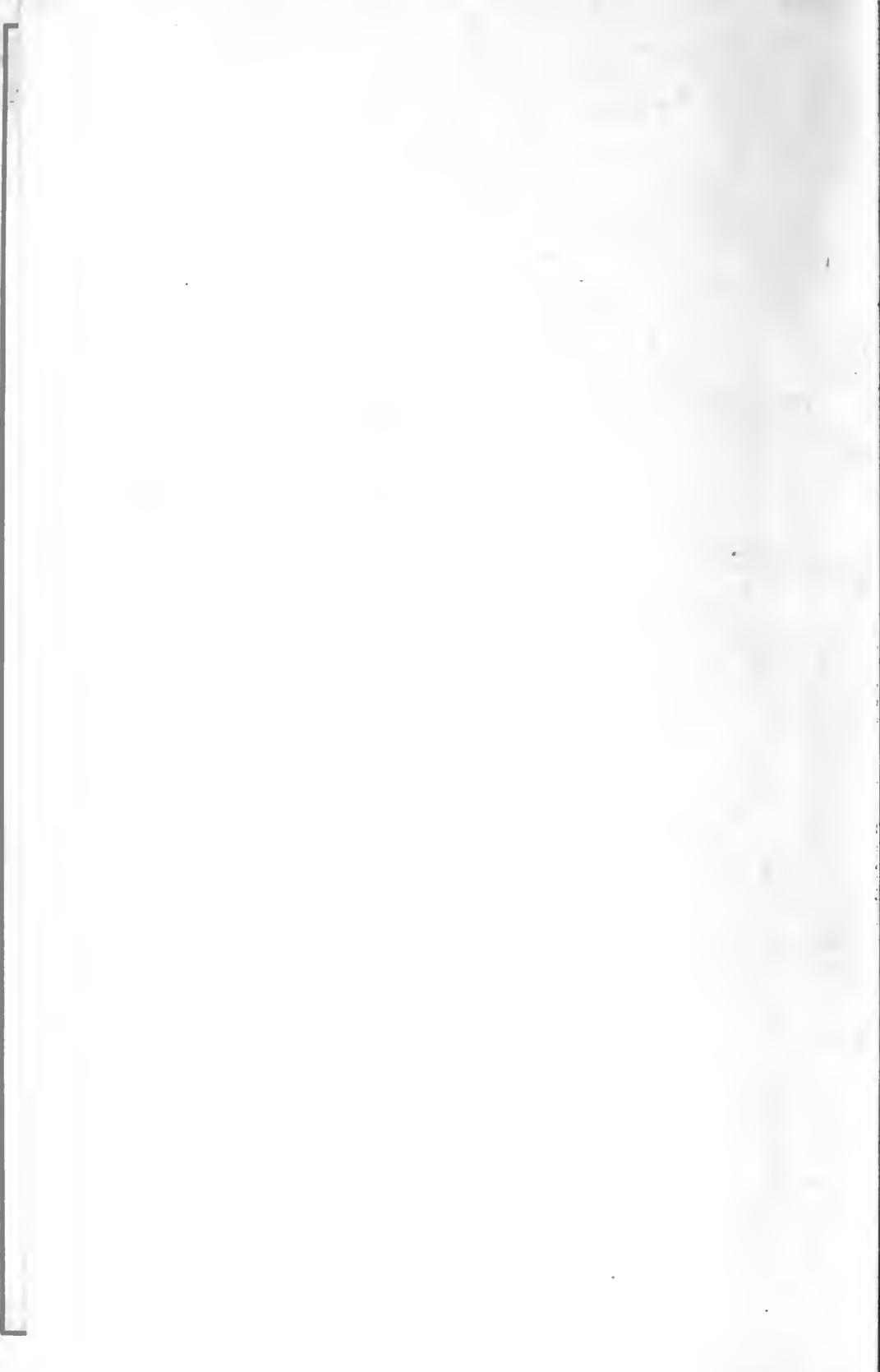
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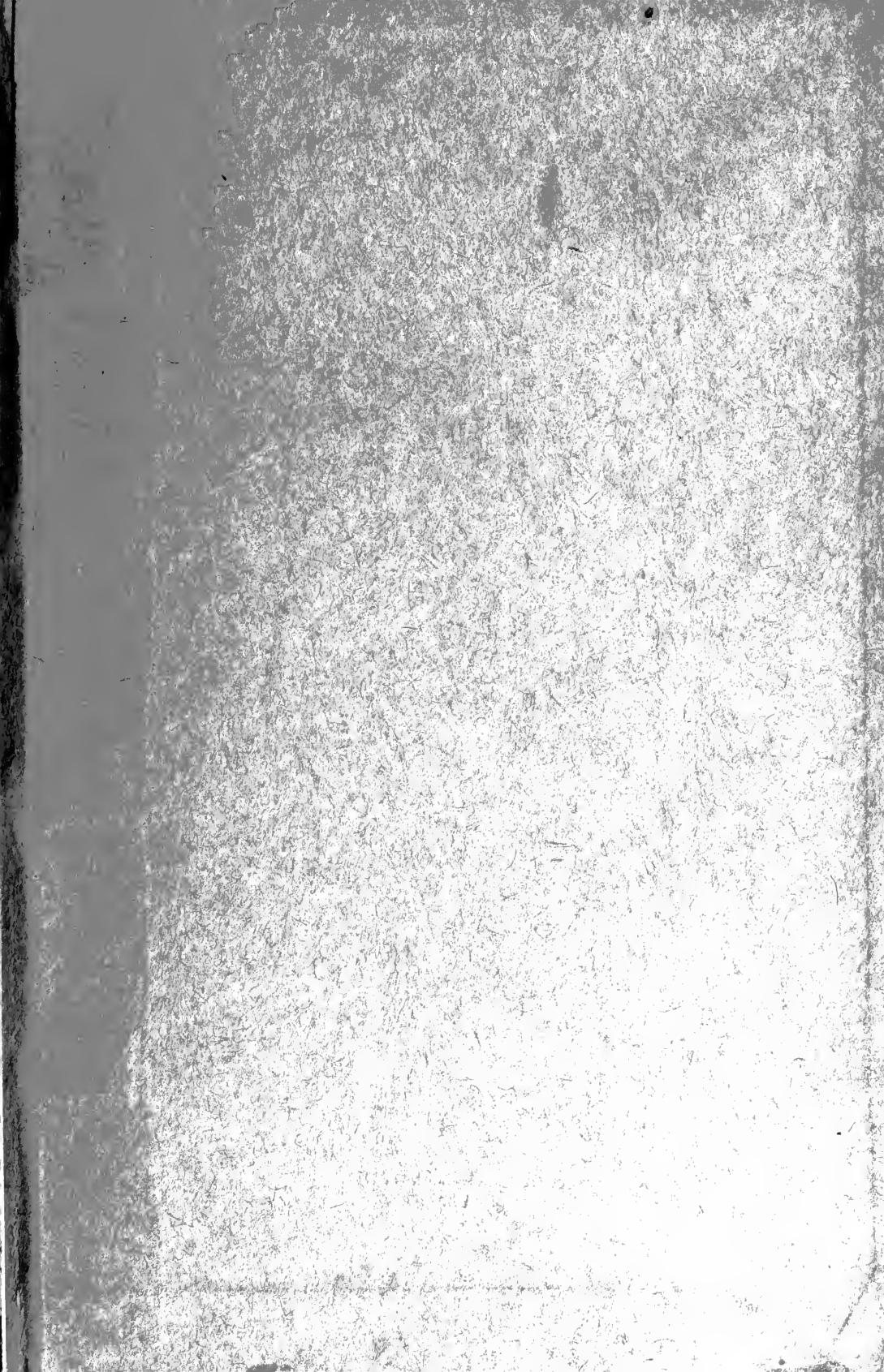
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